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These are
from the
disc

SP-230

SPECIFICATIONS

Speaker used:	12 cm dia.
Rated Input:	2 Watts
Impedance:	8Ω
Frequency response:	100Hz to 5kHz.
Filter cut-off frequency,	
LOW:	400Hz, −3dB.
HIGH 1:	3kHz, −3dB.
HIGH 2:	1.5kHz, −3dB.
HIGH 1 + HIGH 2:	1 kHz, −3dB.
Filter attenuation:	−6dB/oct.
Dimensions:	W 180 mm (7-1/16")
	H 133 mm (5-1/4")
	D 287 mm (11-5/16")
Net weight:	1.8 kg. (4.0 lbs.)
Accessories furnished:	Speaker cord, 1 pc. (E14-0101-05)
	Extension foot, 2 pcs. (J02-0049-14)
	Screw, M4 x 12, 2 pcs. (N30-4012-41)
	1 pin plug, 2 pcs. (E20-1610-05)

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
	A01-0786-03	Case (upper)	
	A01-0789-02	Case (lower)	☆
	A20-2399-05	Panel (T)	☆
	A20-2400-05	Panel (K)(W)	☆
	B46-0058-00	Warranty card (K)	
	B50-2759-00	Operating manual (K)(W)	☆
	B50-2760-00	Operating manual (T)	☆
	E11-0404-05	Phone jack	
	E12-0001-05	Phone plug	
	E13-0361-05	3P Pin jack	
	E14-0101-05	1P Pin plug	
	E30-1610-05	Connector with lead	
	G53-0502-04	Packing	
	H01-2723-04	Carton (inside)(K)(W)	☆
	H01-2724-04	Carton case (inside)(T)	☆
	H10-2523-02	Packing fixture (F)	
	H10-2525-02	Packing fixture (R)	
	H20-0276-03	Protective cover	
	H25-0049-03	Protective bag	
	J02-0049-14	Foot	
	K29-0716-04	Push knob	
	L79-0443-25	Filter	
	RS14AB3D8R2J	Solid 8.2Ω 2W	
	S40-2414-05	Push switch INPUT	
	S42-3401-05	Push switch LOW, HIGH 1, 2	
	T06-0011-05	Speaker	

A product of

TRIO-KENWOOD CORPORATION

17-5, 2-chome, shibuya, shibuya-ku Tokyo 150, Japan

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SP-230

SPECIFICATIONS

Speaker used:	12 cm dia.
Rated Input:	2 Watts
Impedance:	8Ω
Frequency response:	100Hz to 5kHz.
Filter cut-off frequency,	
LOW:	400Hz, −3dB.
HIGH 1:	3kHz, −3dB.
HIGH 2:	1.5kHz, −3dB.
HIGH 1 + HIGH 2:	1 kHz, −3dB.
Filter attenuation:	−6dB/oct.
Dimensions:	W 180 mm (7-1/16")
	H 133 mm (5-1/4")
	D 287 mm (11-5/16")
Net weight:	1.8 kg. (4.0 lbs.)
Accessories furnished:	Speaker cord, 1 pc. (E14-0101-05)
	Extension foot, 2 pcs. (J02-0049-14)
	Screw, M4 x 12, 2 pcs. (N30-4012-41)
	1 pin plug, 2 pcs. (E20-1610-05)

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
	A01-0786-03	Case (upper)	
	A01-0789-02	Case (lower)	☆
	A20-2399-05	Panel (T)	☆
	A20-2400-05	Panel (K)(W)	☆
	B46-0058-00	Warranty card (K)	
	B50-2759-00	Operating manual (K)(W)	☆
	B50-2760-00	Operating manual (T)	☆
	E11-0404-05	Phone jack	
	E12-0001-05	Phone plug	
	E13-0361-05	3P Pin jack	
	E14-0101-05	1P Pin plug	
	E30-1610-05	Connector with lead	
	G53-0502-04	Packing	
	H01-2723-04	Carton (inside)(K)(W)	☆
	H01-2724-04	Carton case (inside)(T)	☆
	H10-2523-02	Packing fixture (F)	
	H10-2525-02	Packing fixture (R)	
	H20-0276-03	Protective cover	
	H25-0049-03	Protective bag	
	J02-0049-14	Foot	
	K29-0716-04	Push knob	
	L79-0443-25	Filter	
	RS14AB3D8R2J	Solid 8.2Ω 2W	
	S40-2414-05	Push switch INPUT A	
	S42-3401-05	Push switch LOW, HIGH 1, 2	
	T06-0011-05	Speaker	

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SP-230

SPECIFICATIONS

Speaker used:	12 cm dia.
Rated Input:	2 Watts
Impedance:	8Ω
Frequency response:	100Hz to 5kHz.
Filter cut-off frequency,	
LOW:	400Hz, −3dB.
HIGH 1:	3kHz, −3dB.
HIGH 2:	1.5kHz, −3dB.
HIGH 1 + HIGH 2:	1 kHz, −3dB.
Filter attenuation:	−6dB/oct.
Dimensions:	W 180 mm (7-1/16")
	H 133 mm (5-1/4")
	D 287 mm (11-5/16")
Net weight:	1.8 kg. (4.0 lbs.)
Accessories furnished:	Speaker cord, 1 pc. (E14-0101-05)
	Extension foot, 2 pcs. (J02-0049-14)
	Screw, M4 x 12, 2 pcs. (N30-4012-41)
	1 pin plug, 2 pcs. (E20-1610-05)

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
	A01-0786-03	Case (upper)	
	A01-0789-02	Case (lower)	☆
	A20-2399-05	Panel (T)	☆
	A20-2400-05	Panel (K)(W)	☆
	B46-0058-00	Warranty card (K)	
	B50-2759-00	Operating manual (K)(W)	☆
	B50-2760-00	Operating manual (T)	☆
	E11-0404-05	Phone jack	
	E12-0001-05	Phone plug	
	E13-0361-05	3P Pin jack	
	E14-0101-05	1P Pin plug	
	E30-1610-05	Connector with lead	
	G53-0502-04	Packing	
	H01-2723-04	Carton (inside)(K)(W)	☆
	H01-2724-04	Carton case (inside)(T)	☆
	H10-2523-02	Packing fixture (F)	
	H10-2525-02	Packing fixture (R)	
	H20-0276-03	Protective cover	
	H25-0049-03	Protective bag	
	J02-0049-14	Foot	
	K29-0716-04	Push knob	
	L79-0443-25	Filter	
	RS14AB3D8R2J	Solid 8.2Ω 2W	
	S40-2414-05	Push switch INPUT	
	S42-3401-05	Push switch LOW, HIGH 1, 2	
	T06-0011-05	Speaker	

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SP-230

SPECIFICATIONS

Speaker used:	12 cm dia.
Rated Input:	2 Watts
Impedance:	8Ω
Frequency response:	100Hz to 5kHz.
Filter cut-off frequency,	
LOW:	400Hz, −3dB.
HIGH 1:	3kHz, −3dB.
HIGH 2:	1.5kHz, −3dB.
HIGH 1 + HIGH 2:	1 kHz, −3dB.
Filter attenuation:	−6dB/oct.
Dimensions:	W 180 mm (7-1/16")
	H 133 mm (5-1/4")
	D 287 mm (11-5/16")
Net weight:	1.8 kg. (4.0 lbs.)
Accessories furnished:	Speaker cord, 1 pc. (E14-0101-05)
	Extension foot, 2 pcs. (J02-0049-14)
	Screw, M4 x 12, 2 pcs. (N30-4012-41)
	1 pin plug, 2 pcs. (E20-1610-05)

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
	A01-0786-03	Case (upper)	
	A01-0789-02	Case (lower)	☆
	A20-2399-05	Panel (T)	☆
	A20-2400-05	Panel (K)(W)	☆
	B46-0058-00	Warranty card (K)	
	B50-2759-00	Operating manual (K)(W)	☆
	B50-2760-00	Operating manual (T)	☆
	E11-0404-05	Phone jack	
	E12-0001-05	Phone plug	
	E13-0361-05	3P Pin jack	
	E14-0101-05	1P Pin plug	
	E30-1610-05	Connector with lead	
	G53-0502-04	Packing	
	H01-2723-04	Carton (inside)(K)(W)	☆
	H01-2724-04	Carton case (inside)(T)	☆
	H10-2523-02	Packing fixture (F)	
	H10-2525-02	Packing fixture (R)	
	H20-0276-03	Protective cover	
	H25-0049-03	Protective bag	
	J02-0049-14	Foot	
	K29-0716-04	Push knob	
	L79-0443-25	Filter	
	RS14AB3D8R2J	Solid 8.2Ω 2W	
	S40-2414-05	Push switch INPUT	
	S42-3401-05	Push switch LOW, HIGH 1, 2	
	T06-0011-05	Speaker	

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Counter Unit (X54-1540-00)

Connector No	Terminal No	Terminal	Remarks	Destination			
				Unit/switch	Connector No	Terminal No.	Terminal
①	1	DH	Display hold	DH SW S12			
	2	0.5	0.5 MHz shift	EXT VFO socket		6	0.5
	3	12	+ 12V				
②				PLL unit	②		
③				PLL unit	①		
④				RF unit	①		
⑤	1	28	To + 0.5 SW S7-1	RF unit	②	1	28
	2	28.5					
	3	29	To + 0.5 SW S7-2	RF unit	②	2	29
	4	29.5					

VFO Unit (X40-1170-00)

	1	RLC	From MODE SW S18-5	MODE SW S18-5			RLC
	2	RIT	RIT Voltage input	AF unit	⑦	9	RIT
	3	VFB	VFO B + 9V	FIX SW S4			VFB
	4	GND					
	5	VFO	VFO output	PLL unit	⑤	2	VFO

FINAL Unit (X56-1380-00)

		FG	Control grid bias	AF unit			FG
		H	Heater voltage AC 12.3V				
		SG	Screen grid voltage	Rectifier unit			PD2
		IPM	IP meter voltage	Meter SW S13			
		DRV	Drive input	RF unit			DRV

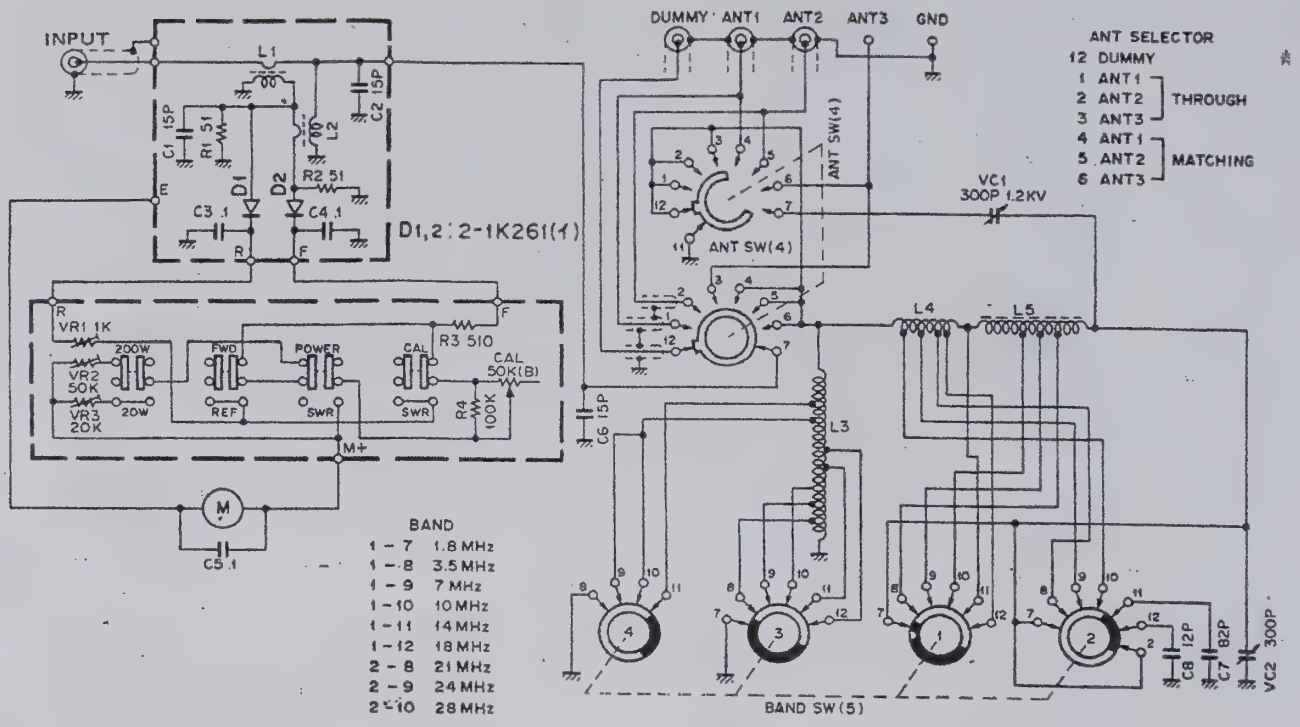
RF unit (X44-1360-00)

①				Counter unit	④		
②	1	28	To + 0.5 SW S7-1	+ 0.5 SW S7-1			
	2	29	To + 0.5 SW S7-2	+ 0.5 SW S7-2			
	3	9V	+ 9V				
③	1	RLR	+ 9V on RX	RLR Line			
	2	G					
	3	ANT	Receiver antenna input	RF ATT SW S6-1			
④	1	G					
	2	MKR	Marker input	PLL unit	④	2	MKR
⑤	1	AGC	AGC voltage	IF unit	⑬	3	AGC
	2	RIF	RX IF output	IF unit	⑥	6	RIF
	3	G					
⑥	1	TOF	TX turn off signal	AF unit	⑥	4	TOF
	2	12	+ 12V				
	3	MXB	Bias for TX MIXer	AF unit	⑥	3	MXB
⑦	1	12	+ 12V				
	2	TIF	TX IF input	IF unit	⑥	3	TIF
	3	G					
	4	300A	300 B +	IF unit	⑬	1	300A
⑧	1	DRB	Control grid bias for V1	AF unit	⑥	5	DRB
	2	RB1	Bias for Q1 RF amp	AF unit	⑥	1	RB1
⑨	1	H	Heater voltage AC 12.3V				
	2	210A	210 B +				
⑩	1	G					
	2	UV	Transverter output	X. VTER socket		7	UV
		NC	Neutralization	Final tank circuit			
		DRV	Drive output	Final unit			DRV
		VCO	VCO input	PLL unit			VCO
		NFB	Negative feed back	Final tank circuit			

Rectifier unit (X43-1370-00)

		HV	High voltage signal to METER	METER SW S13			HV
		800	800 B +				
		300B	300 B +				
		210B	210 B +				
		210A	210 B +				
		STB	Side tone voltage	AF unit			STB
		−C	Common B − Approx. −100V				
		SG2	Screen grid voltage	MODE SW S18-2			SG2
		TUN	Screen grid low voltage for TUN	MODE SW S18-2			TUN
		12	+ 12V				
		SGS	To SG SW	SG SW S20			SGS
		SG1	To MODE SW	MODE SW S18-2			SG1
		PD2	Screen grid voltage	Final unit			SG
		PD1					

AT-230



SPECIFICATIONS

ANTENNA COUPLER

Frequency Range	9 amateur bands from 1.8 to 29.7 MHz
Input Impedance	50Ω
Output Impedance	10 to 500Ω, unbalanced
Through Power	200W at max.
Insertion Loss	Less than 0.5 dB in matched state
Pi-L	1.8 MHz only
Output Impedance	20 to 500Ω, unbalanced
Through Power	100W at max.

WATTMETER

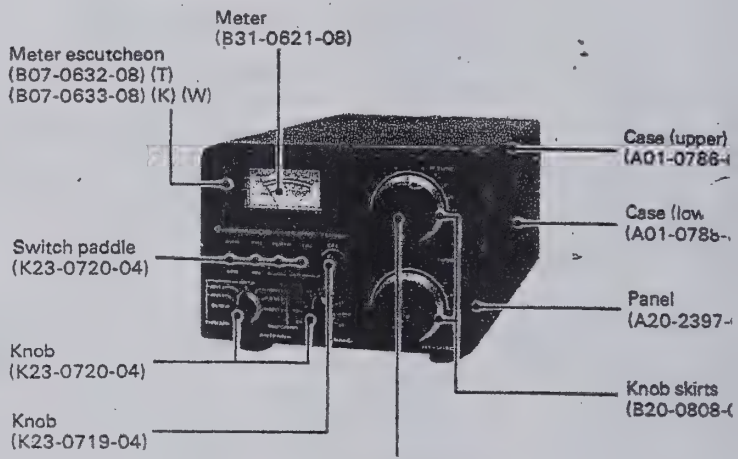
Type	Through-line wattmeter
Frequency Range	1.8 to 30 MHz
Measurable RF Power	Up to 20/200W, switched
Kinds of RF Power	Forward or reflected power, switched.
Net weight	3.4 kg (7.5 lbs.) approx.
Impedance	50Ω
Accuracy	Better than ±10% of full scale

SWR METER

SWR Detection	Toroid core direction coupler
Measurable Range	1.1 to 10
Min. Power Required	4W

GENERAL

Connectors	
INPUT	UHF type, 50Ω
ANT-1	UHF type
ANT-2	UHF type
ANT-3	Stud and wing nut
Dimensions	W 180 mm (7-3/32″)
	H 133 mm (5-15/64″)
	D 288 mm (11-11/32″)



AT-230 General

Ref. No.	Parts No.	Description	Remarks
	A01-0786-03	Case (upper)	☆
	A01-0788-02	Case (lower)	☆
	A20-2397-02	Panel	☆
	B07-0632-08	Meter escutcheon (T)	☆
	B07-0633-08	Meter escutcheon (K)(W)	☆
	B20-0808-04	Knob skirt	
	B31-0621-08	Meter	
	B46-0058-00	Warranty card (K)	
	B50-2756-08	Operating manual (K)(W)	☆
	B50-2757-08	Operating manual (T)	☆
VC1, 2	C02-0016-08	Variable cap 300pF 1.2kV	
C7	C91-0419-05	C 82pF 3kV	☆
C8	C91-0402-05	C 12pF 3kV	☆
	D23-0061-04	Bearing	

Ref. No.	Parts No.	Description	Re-marks
	E04-0102-05	UHF type receptacle	
	E23-0015-04	Gnd lug ϕ3	
	E23-0408-05	Terminal	
	F09-0402-05	Insulating cover	
	F29-0402-08	Insulator	
	G13-0621-04	Cushion	
	H01-2714-04	Carton case (inside)(K)(W)	☆
	H01-2715-04	Carton case (inside)(T)	☆
	H10-2525-02	Packing fixture (R)	☆
	H10-2545-02	Packing fixture (F)	☆
	J02-0049-14	Foot (large)	
	J32-1030-04	Round boss	
	K21-0715-04	Main knob R, X Tune	
	K21-0745-08	Knob, BAND, ANT	
	K23-0719-04	Knob, CAL	
	K23-0720-04	Switch paddle	
L3	L34-0992-08	Coil	☆
L4	L34-0993-08	Coil	☆
L5	L34-0994-08	Coil	☆
	N14-0506-08	Wing nut, M5 ANT3, GND	
	S01-2418-08	Rotary switch, ANT	
	S01-5404-08	Rotary switch, BAND	☆
	W02-0302-08	Switch module	
	W02-0303-08	Detector module	

Switch module (W02-0302-08)

Ref. No.	Parts No.	Description	Re-marks
VR1	R12-1024-05	Trim. pot 1kΩ (B)	
VR2	R12-4020-05	Trim. pot 50kΩ (B)	
VR3	R12-3420-08	Trim. pot 20kΩ (B)	
VR4	R05-3407-08	Pot. 50kΩ (B) CAL	
R3	RD14BB2E511J	Carbon resistor 510Ω ±5% 1/4W	
R4	RD14BB2E104J	Carbon resistor 100kΩ ±5% 1/4W	
	S36-2026-15	Paddle switch × 4	

Detector module (W02-0303-08)

Ref. No.	Parts No.	Description	Re-marks
C1, 2	FM05ZC150J5	Mica 15pF 500V	
C6	FM05ZC150J5	Mica 15pF 500V	
R1, 2	RD14BB2E510J	Carbon resistor 51Ω ±5% 1/4W	
D1, 2	V11-7763-26	Diode 2-1K261 × 2	
L1, 2	L39-0403-08	Detector coil	

1. INSTRUMENTS

1) Terminated Power Meter

1. Frequency range: 50 MHz or more
2. Input impedance: 50Ω
3. Power range: 20W and 200W

2) HF Transmitter or Transceiver

1) Output: 100W CW
Variable to 10W.
Example: TS-830, TS-820S

2. POWER METER ADJUSTMENT

1) Test Equipment Connection

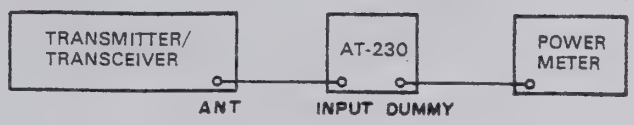


Fig. 1

2) Adjustment

1. Connect as in Fig. 1.
2. Unless otherwise specified, controls should be set as follows:

ANT SW	DUMMY
BAND SW	14
200W/20W SW	200W
FWD/REF SW	FWD
POWER/SWR SW	POWER
CAL/SWR SW	SWR

Tune up the transceiver at 14.175 MHz.

3. Adjust the transceiver for 100W output at the power meter (adjusted by the carrier level control).
Adjust VR2 on the switch unit for a meter reading of 100 on the AT-230.

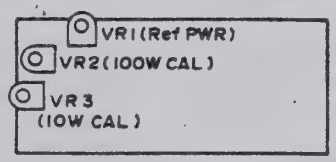


Fig. 2

4. As in step 3, lower transceiver output to 10W and adjust VR3 for a meter indication of 10 on the 20W scale.

3. CALIBRATION OF REF POWER

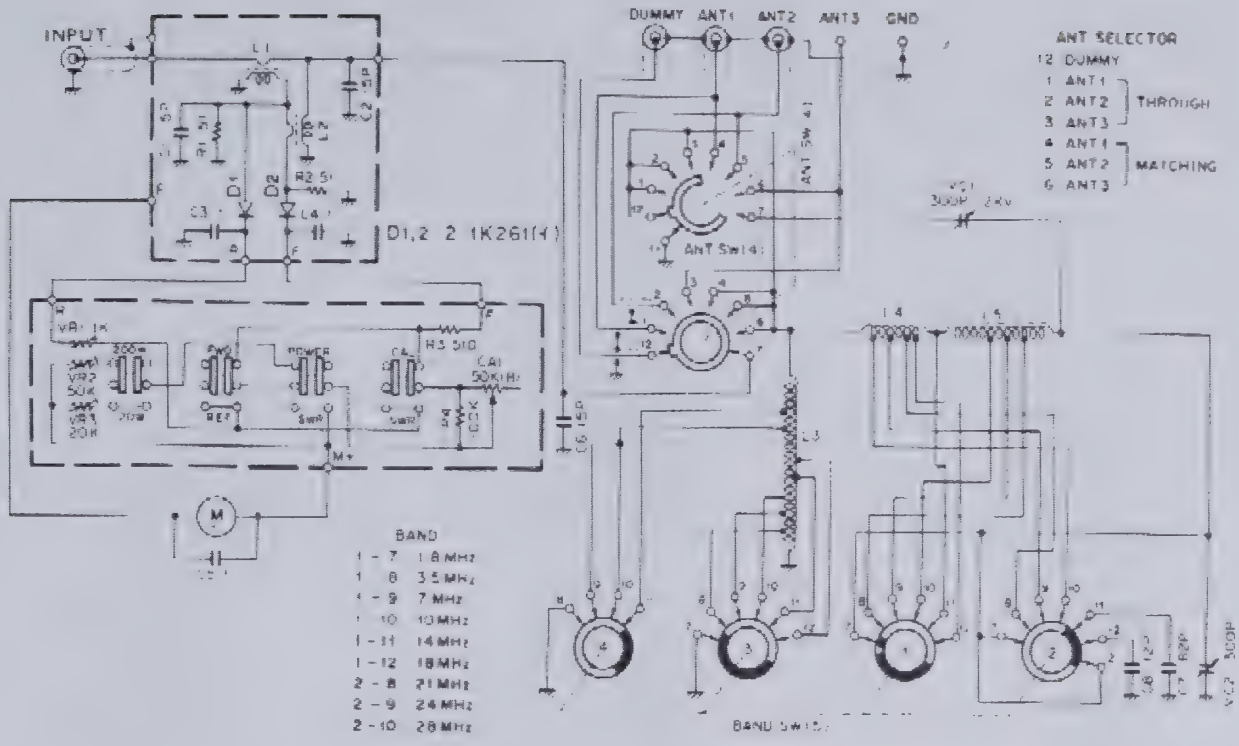
1) Connection

As in Fig. 1.

2) Adjustment

1. Set controls as described in 2.2.
Confirm 100W CW output reading.
2. Unkey the transceiver and reverse the coaxial cable between the INPUT and DUMMY terminals on the AT-230. Move the FWD/REF switch to the REF position.
3. Transmit and adjust VR1 for previously confirmed 100W reading.

AT-230



SPECIFICATIONS

ANTENNA COUPLER

Frequency Range	9 amateur bands from 1.8 to 29.7 MHz
Input Impedance	50Ω
Output Impedance	10 to 500Ω, unbalanced
Through Power	200W at max
Insertion Loss	Less than 0.5 dB in matched state
Pi-L	1.8 MHz only
Output Impedance	20 to 500Ω, unbalanced
Through Power	100W at max.

WATTMETER

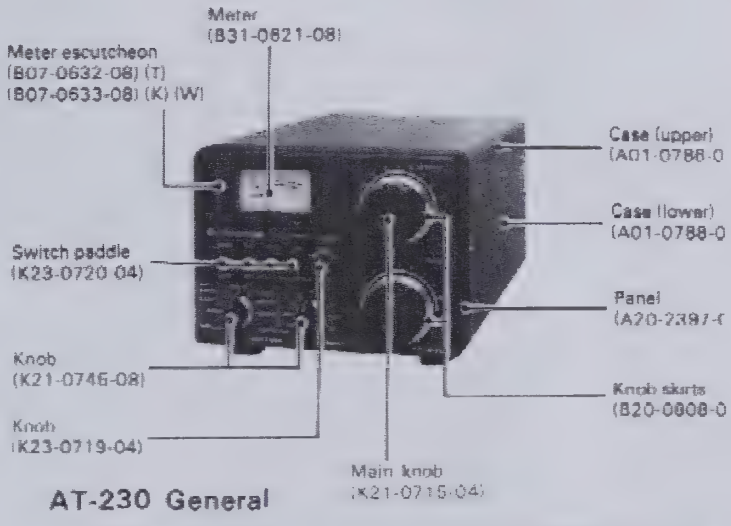
Type	Through-line wattmeter
Frequency Range	1.8 to 30 MHz
Measurable RF Power	Up to 20/200W, switched
Kinds of RF Power	Forward or reflected power switched.
Net weight	3.4 kg (7.5 lbs) approx
Impedance	50Ω
Accuracy	Better than ±10% of full scale

SWR METER

SWR Detection	Toroid core direction coupler
Measurable Range	1.1 to 10
Min. Power Required	4W

GENERAL

Connectors	
INPUT	UHF type, 50Ω
ANT-1	UHF type
ANT-2	UHF type
ANT-3	Stud and wing nut
Dimensions	W 180 mm (7-3/32")
	H 133 mm (5-15/64")
	D 288 mm (11-11/32")



AT-230 General

Ref. No.	Parts No	Description	Remarks
	A01-0788-03	Case (upper)	☆☆
	A01-0788-02	Case (lower)	☆
	A20-2397-02	Panel	☆
	B07-0632-08	Meter escutcheon (T)	☆
	B07-0633-08	Meter escutcheon (K)(W)	☆
	B20-0808-04	Knob skirt	
	B31-0621-08	Meter	
	B46-0058-00	Warranty card (K)	
	B50-2756-08	Operating manual (K)(W)	☆
	B50-2757-08	Operating manual (T)	☆
VC1, 2	C02-0016-08	Variable cap 300pF 1.2kV	
C7	CH1-0419-05	C 82pF 3kV	☆
C8	CH1-0402-05	C 12pF 3kV	☆
	D23-0061-04	Bearing	

Ref. No	Parts No	Description	Re-marks
	E04-0102-05	UHF type receptacle	
	E23-0015-04	Gnd lug ϕ3	
	E23-0408-05	Terminal	
	F09-0402-05	Insulating cover	
	F29 0402-08	Insulator	
	G13-0621-04	Cushion	
	H01-2714-04	Carton case (inside)(K)(W)	☆
	H01-2715-04	Carton case (inside)(T)	☆
	H10-2525-02	Packing fixture (R)	☆
	H10-2545-02	Packing fixture (F)	☆
	J02-0049-14	Foot (large)	
	J32-1030-04	Round boss	
	K21-0715-04	Main knob R, X Tune	
	K21-0745-08	Knob, BAND, ANT	
	K23-0719-04	Knob, CAL	
	K23-0720-04	Switch paddle	
L3	L34-0992-08	Coil	☆
L4	L34-0993-08	Coil	☆
L5	L34-0994-08	Coil	☆
	N14-0506-08	Wing nut, M5 ANT3, GND	
	S01-2418-08	Rotary switch, ANT	
	S01-5404-08	Rotary switch, BAND	☆
	W02-0302-08	Switch module	
	W02-0303-08	Detector module	

Switch module (W02-0302-08)

Ref. No	Parts No.	Description	Re-marks
VR1	R12-1024-05	Trim. pot 1kΩ (B)	
VR2	R12-4020-05	Trim. pot 50kΩ (B)	
VR3	R12-3420-08	Trim. pot 20kΩ (B)	
VR4	R05-3407-08	Pot. 50kΩ (B) CAL	
R3	RD14BB2E511J	Carbon resistor 510Ω ±5% 1/4W	
R4	RD14BB2E104J	Carbon resistor 100kΩ ±5% 1/4W	
	S36-2026-15	Paddle switch × 4	

Detector module (W02-0303-08)

Ref. No.	Parts No.	Description	Re-marks
C1, 2	FM05ZC150J5	Mica 15pF 500V	
C6	FM05ZC150J5	Mica 15pF 500V	
R1, 2	RD14BB2E510J	Carbon resistor 51Ω ±5% 1/4W	
D1, 2	V11-7763-26	Diode 2-1K261 × 2	
L1, 2	L39-0403-08	Detector coil	

1. INSTRUMENTS

1) Terminated Power Meter

1. Frequency range: 50 MHz or more
2. Input impedance: 50Ω
3. Power range: 20W and 200W

2) HF Transmitter or Transceiver

1) Output: 100W CW
Variable to 10W
Example: TS-830, TS-820S

2. POWER METER ADJUSTMENT

1) Test Equipment Connection

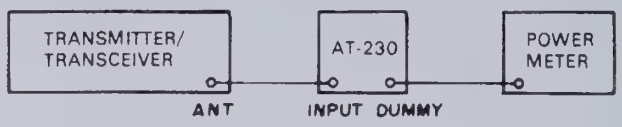


Fig. 1

2) Adjustment

1. Connect as in Fig. 1
2. Unless otherwise specified, controls should be set as follows:

ANT SW	DUMMY
BAND SW	14
200W/20W SW	200W
FWD/REF SW	FWD
POWER/SWR SW	POWER
CAL/SWR SW	SWR

Tune up the transceiver at 14 175 MHz

3. Adjust the transceiver for 100W output at the power meter (adjusted by the carrier level control)
Adjust VR2 on the switch unit for a meter reading of 100 on the AT-230

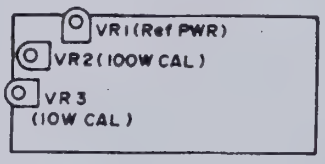


Fig. 2

4. As in step 3, lower transceiver output to 10W and adjust VR3 for a meter indication of 10 on the 20W scale

3. CALIBRATION OF REF POWER

1) Connection

As in Fig. 1

2) Adjustment

1. Set controls as described in 2 2
Confirm 100W CW output reading.
2. Unkey the transceiver and reverse the coaxial cable between the INPUT and DUMMY terminals on the AT-230. Move the FWD/REF switch to the REF position
3. Transmit and adjust VR1 for previously confirmed 100W reading

AF Unit (X49-1140-00)

Connector No.	Terminal No	Terminal	Remarks	Destination			
				Unit/switch	Connector No.	Terminal No.	Terminal
①	1	GND					
	2	DET	Detector input	IF unit	⑪	1	DET
	3	SSB	Bias voltage for SSB	IF unit	⑨	1	SSB
	4	GND					
	5	VXI	VOX input	IF unit	⑨	3	VXI
	6	NBI	Noise blanker input	IF unit	②	1	NBI
		STB		Rectifier unit			STB
②	1	AV2	Arm of AF gain control	AF gain control			
	2	GND					
	3	AV1	Top of AF gain control	AF gain control			
	4	GND					
	5	STE	To ground in CW and CW NAR	MODE SW S18-6			STE
	6	KEY	To ground in Tune. USB and LSB	MODE SW S18-6			KEY
③	1	SP	Speaker internal	REMOTE socket		1	SP
	2	GND					
	3	STS	Side tone SW	KEY Jack		7	STS
④	1	SS	Stand by SW	REMOTE socket		3	SS
	2	VXS	VOX switch to ground VOX on	VOX SW			
	3	VXD	VOX delay control	VOX delay control			
	4	VXG	VOX gain control	VOX gain control			
	5	GND					
	6	SP	Speaker output	Phone jack		2	
⑤	1	VR3	Final bias control	Bias control		3	VR3
	2	KEY	Key jack	KEY jack		2	KEY
	3	VR1	Final bias control	Bias control		1	VR1
	4	AV	Anti VOX arm	Anti VOX control		2	AV
	5	SS	Stand by SW	Stand by SW S17			SS
	6	RL	Relay Voltage +12.3V on TX	IF unit	⑩	3	RL
	7	9	+9V	EXT VFO socket		3	9
⑥	1	RB1	Bias for Q1 RF amp on RF unit	RF unit	⑧	2	RB1
	2	GND					
	3	MXB	From Q18 on AF unit bias to MIXer	RF unit	⑥	3	MXB
	4	TOF	TX stop signal for WARC	RF unit	⑥	1	TOF
	5	DRB	Bias for control grid V1	RF unit	⑧	1	DRB
⑦	1	XIT	Transmitter incremental tuning	XIT SW S2-1			XIT
	2	TM	Meter select switch S13 arm	Meter SW S13			TM
	3	RLT	Relay +9V on TX	MODE SW S18-3			RLT
	4	RSC	Receiver RIT ON	RIT SW S3-1			RSC
	5	RLR	Relay +9V on RX	MODE SW S18-5			RLR
	6	M	Meter voltage	Meter			
	7	−6	Bias voltage −6V				
	8	RTI	RIT SW	RIT SW S3-1			RTI
	9	RIT	RIT to VFO	VFO unit		2	RIT
		FG	Bias for control grid Final	Final unit			FG
⑧	1	XAL	Transmitter ALC	X.VTER socket		6	XAL
	2	RAL	ALC input remote socket	REMOTE socket		6	RAL
	3	VR2	Arm of TX bias control	Bias control			
⑨	1	NBV	Top of noise blanker VR	NB control			
	2	NBS	Noise blanker SW	NB SW S16			
	3	9	+9V				
	4	SSB	+9V in USB/LSB	MODE SW S18-4			SSB
	5	RF1	Top of RF gain control	RF gain control			
⑩	1	NSG	Noise blanker gate signal	IF unit	②	4	NSG
	2	GND					
	3	ALC	ALC voltage from Q19 on AF unit	IF unit	⑤	3	ALC
	4	RB2	Receiver bias for IF unit	IF unit	⑨	5	RB2
	5	TB	TX bias	IF unit	⑤	1	TB
	6	SM	S meter signal	IF unit	⑨	2	SM
	7	RS	Ground on RX	IF unit	⑤	2	RS

IF unit (X48-1290-00)

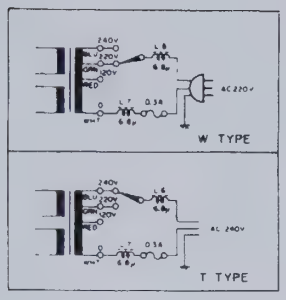
①	1	IFO1		IF OUT 1 jack			IFO1
	2	G					
②	1	NBI	Noise blanker input	AF unit	①	6	NBI
	2	G					
	3	G					
	4	NSG	Noise blanker gate signal	AF unit	⑩	1	NSG
③	1	−6	−6V				
	2	PRO	Processor SW	Processor SW S15-1			PRO
	3	COT	Arm of VR9-2 processor gain control	VR9-2			COT
	4	COM	Compression meter signal	Meter SW S13			COM

TS-830S SCHEMATIC ABBREVIATION

Connector No.	Terminal No	Terminal	Remarks	Destination			
				Unit/switch	Connector No.	Terminal No.	Terminal
④	1	RLT		MODE SW S18-3			RLT
	2	SSB1		MODE SW S18-5			SSB1
	3	ALM	ALC meter DC signal	Meter SW S13			ALM
	4	9	+9V				
⑤	1	TB	Transmit bias	AF unit	⑯	5	TB
	2	RS	Ground on TX	AF unit	⑯	7	RS
	3	ALC	ALC input from AF unit Q19	AF unit	⑯	3	ALC
		CW1		MODE SW S 18-5			CW1
⑥	1	12	+12V				
	2	G					
	3	TIF	TX IF output	RF unit	⑦	2	TIF
	4	G					
	5	G					
	6	RIF	RX IF input	RF unit	⑤	2	RIF
⑦	1	MIC	MIC input	MIC jack		1	
	2	G					
	3	G					
	4	MV1	Top of MIC gain control	MIC gain control VR9-1			
	5	MV2	Arm of MIC gain control	PRO SW S15-2			
	6	G					
⑧	1	CV	Arm of carrier control	CAR control VR9-3			CV
	2	RFG	Arm of RF gain control	RF gain control VR3-1			RFG
	3	AGS	AGC SW slow	AGC SW S11-2			AGS
	4	AGO	AGC OFF	AGC SW S11-1			AGO
	5	NCH	Notch frequency control voltage	Notch SW S1-1			NCH
⑨	1	SSB	Bias voltage for SSB	AF unit	①	3	SSB
	2	SM	Smeter DC signal	AF unit	⑯	6	SM
	3	VXI	To VOX circuit	AF unit	①	5	VXI
	4	G					
	5	RB2	RX bias	AF unit	⑯	4	RB2
⑩	1	IFO2	IF output for monitor	IF OUT 2 jack			IFO2
	2	G					
	3	RL	TX bias for Q22 on IF unit from relay drive voltage				
⑪	1	DET	Detector output	AF unit	①	2	DET
	2	G					
	3	CAR1					
	4	CAR2					
⑫	1	MX	Monitor ON SW	Monitor SW S5			
	2	MOE	Monitor signal ground				
	3	MO	Monitor signal output	AF gain control VR3-2			MO
	4	VBT	Arm of VR1-1	VBT control VR1-1			VBT
⑬	1	CAR	CAR input	PLL unit	⑦	2	CAR
	2	G					
⑭	1	210A	210 B +	Rectifier unit			210A
	2	G					
	3	210B	210 B +	Rectifier unit			210B
	4	300B	300 B +	Rectifier unit			300B
⑮	1	300A	300 B +	RF unit	⑦	4	300A
	2	G					
	3	AGC	Output for AGC	RF unit	⑤	1	AGC

PLL Unit (X50-1680-00)

①				Counter unit	③		
②				Counter unit	②		
③				Counter unit	②		
④	1	G		RF unit	④	1	G
	2	MKR	Marker output	RF unit	④	2	MKR
⑤	1	G		VFO unit		4	GND
	2	VFO	VFO input	VFO unit		5	VFO
		VCO	VCO output	RF unit			VCO
⑥	1	VFO	VFO input	EXT. VFO socket		1	VFO
	2	G					
	3	TXC	EXT VFO Socket	EXT VFO Socket		4	TXC
⑦	1	G					
	2	CAR	Carrier output	IF unit	⑬	1	CAR
⑧	1	9	+9V				
	2	RLR	Relay +9V on RX				
	3	MS	Calibrator SW S10	CAL SW S10			
	4	LSB	+9V on LSB mode	MODE SW S18-1			LSB
	5	USB	+9V on TUN~USB	MODE SW S18-1			USB
	6	IFS	Arm of VR2-2 IF shift control	IF SHIFT VR2-2			IFS
	7	TXC	MODE SW S18-3	MODE SW S18-3			TXC
	8	FXB	For FIX indicator	FIX IND. D2			
	9	RLS	MODE SW S18-3	MODE SW S18-3			RLS



SLP-144

TLR-205

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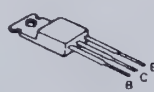
2SA1015(Y)
2SC1775(E)
2SC1815(Y)
2SC1959(Y)

2SD880(Y)



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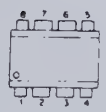

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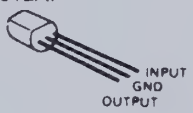
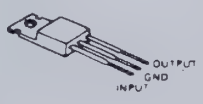


TC5081P

μPC1037H

μPC14305H

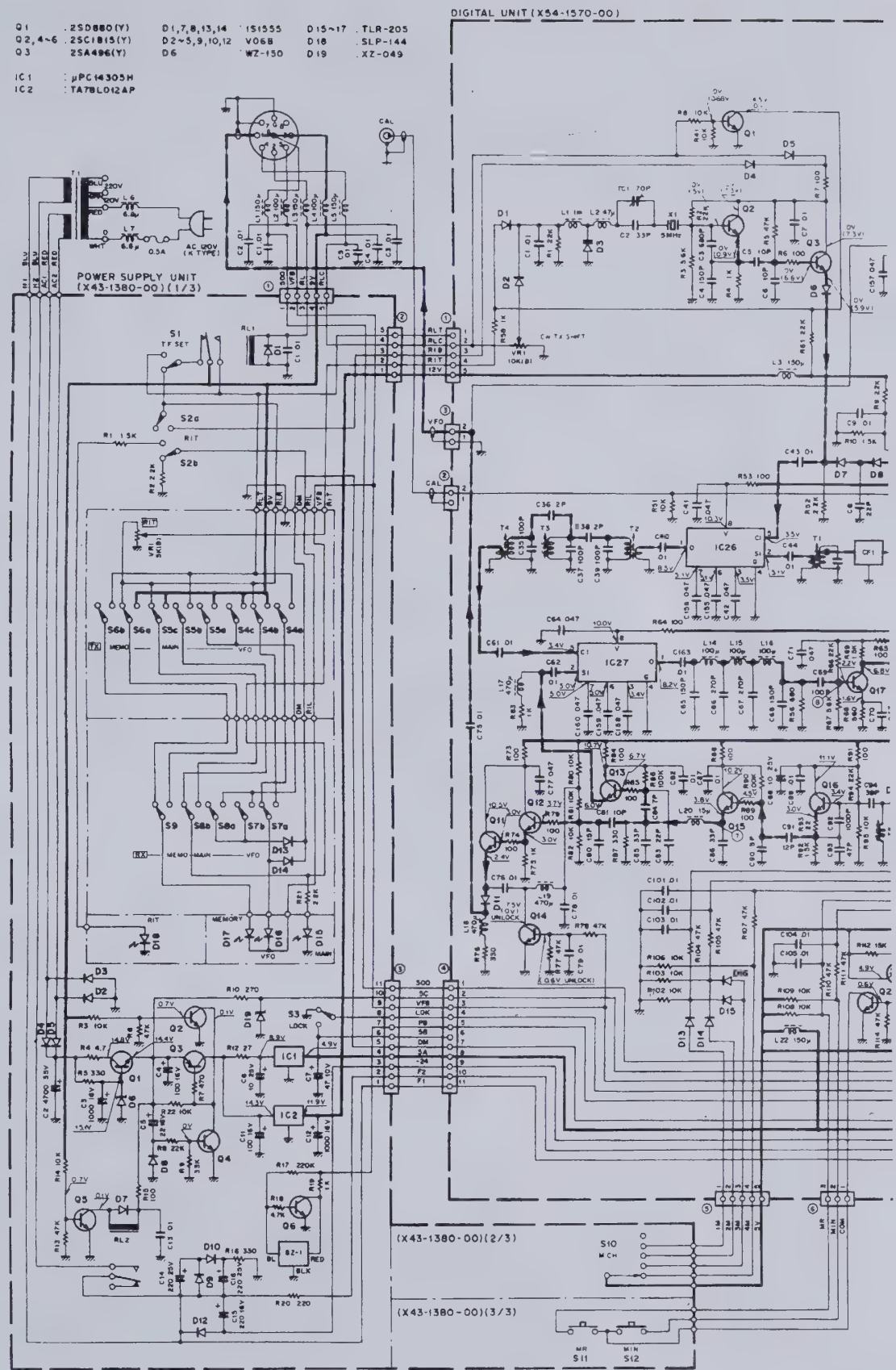


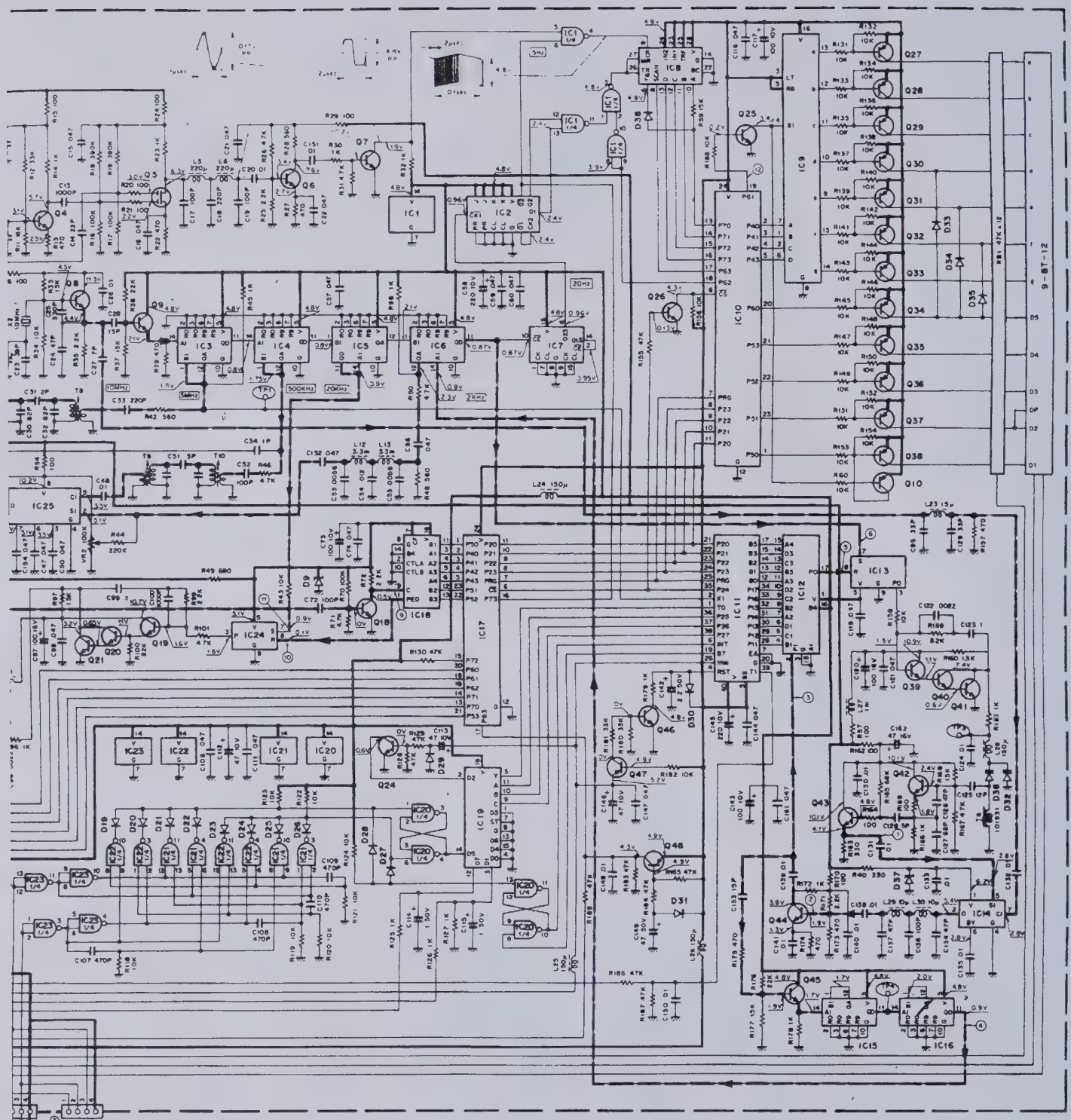
Q1 . 2SD880(Y)
Q2,4~6 . 2SC1815(Y)
Q3 2SA496(Y)

IC1 : μPC14305H
IC2 : TA78L012AP

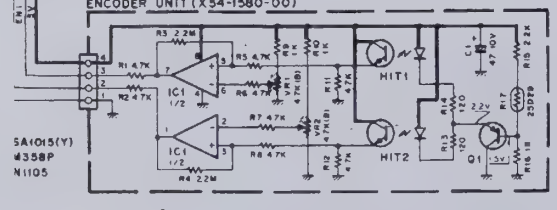
D1,7,8,13,14 : 1S1555
D2~5,9,10,12 : V06B
D6 : WZ-150

D15~17 . TLR-205
D18 . SLP-144
D19 . XZ-049



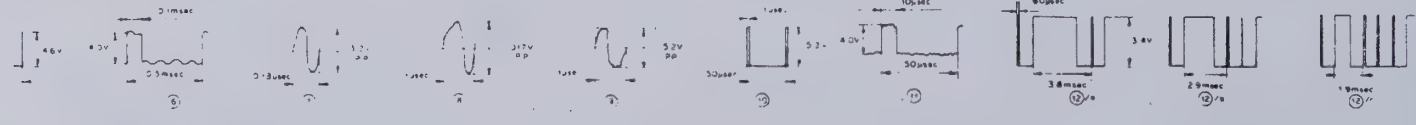


ENCODER UNIT (X54-1580-00)

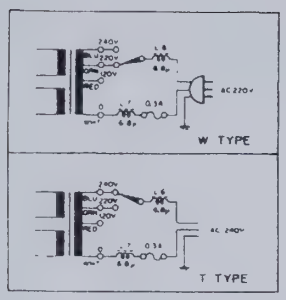


Q1~4, 6~9, 12, 13, 15~18, 23~26, 42~46	: 2SC1815(Y)
Q5	: 3SK73(GR)
Q11, 14	: 2SC1959(Y)
Q19~21, 39~41	: 2SC1775(E)
Q10, 22, 27~38, 47, 48	: 2SA1015(Y)
IC1, 20~23	: TC40118P
IC2	: TC4027BP
IC3~6, 15, 16	: SN74LS90N
IC7	: TC4518BP
IC8	: TC5032P
IC9	: SN74LS247N
IC10, 17	: μPD8243C
IC11	: μPD8048C-155
IC12	: TC9122P
IC13, 24	: TC5081P
IC14	: μPC1037H
IC18	: MC145698
IC19	: HD74LS151P
IC25~27	: SN16913P
D1, 2, 4, 5, 13~31, 33~35, 38	: 1S1555
D3, 10, 12, 32, 36	: 1SV54BC
D6~8, 11	: 1S1587
D9	: WZ-050
D37	: WZ-061

Display : 0.0~9.9 : 100.0~599.9 : 10.0~99.9



<Note>Wave forms are displayed at 0.0 (VFO output 5.5 MHz)



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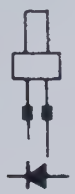

TLR-205

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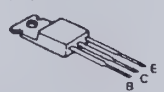
2SA1015(Y)
2SC1775(E)
2SC1815(Y)
2SC1959(Y)

2SD880(Y)



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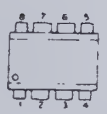

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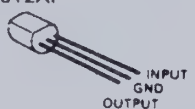
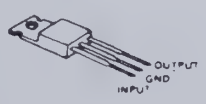
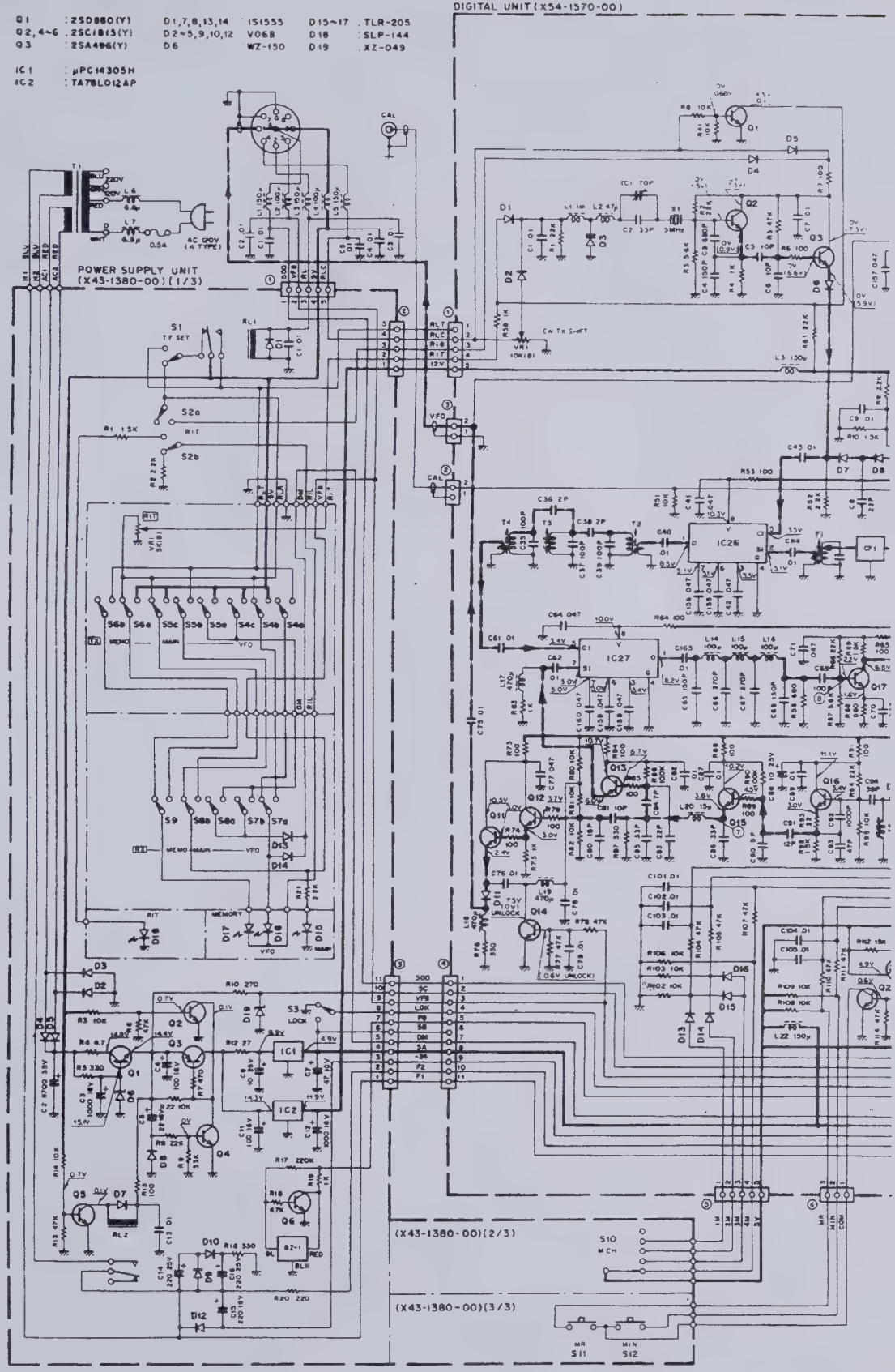


TC5081P

μPC1037H

μPC14305H





Counter Unit (X54-1540-00)

Connector No	Terminal No	Terminal	Remarks	Destination			
				Unit/switch	Connector No	Terminal No.	Terminal
①	1	DH	Display hold	DH SW S12			
	2	0.5	0.5 MHz shift	EXT VFO socket		6	0.5
	3	12	+ 12V				
②				PLL unit	②		
③				PLL unit	①		
④				RF unit	①		
⑤	1	28	To + 0.5 SW S7-1	RF unit	②	1	28
	2	28.5					
	3	29	To + 0.5 SW S7-2	RF unit	②	2	29
	4	29.5					

VFO Unit (X40-1170-00)

	1	RLC	From MODE SW S18-5	MODE SW S18-5			RLC
	2	RIT	RIT Voltage input	AF unit	⑦	9	RIT
	3	VFB	VFO B + 9V	FIX SW S4			VFB
	4	GND					
	5	VFO	VFO output	PLL unit	⑤	2	VFO

FINAL Unit (X56-1380-00)

		FG	Control grid bias	AF unit			FG
		H	Heater voltage AC 12.3V				
		SG	Screen grid voltage	Rectifier unit			PD2
		IPM	IP meter voltage	Meter SW S13			
		DRV	Drive input	RF unit			DRV

RF unit (X44-1360-00)

①				Counter unit	④		
②	1	28	To + 0.5 SW S7-1	+ 0.5 SW S7-1			
	2	29	To + 0.5 SW S7-2	+ 0.5 SW S7-2			
	3	9V	+ 9V				
③	1	RLR	+ 9V on RX	RLR Line			
	2	G					
	3	ANT	Receiver antenna input	RF ATT SW S6-1			
④	1	G					
	2	MKR	Marker input	PLL unit	④	2	MKR
⑤	1	AGC	AGC voltage	IF unit	⑬	3	AGC
	2	RIF	RX IF output	IF unit	⑥	6	RIF
	3	G					
⑥	1	TOF	TX turn off signal	AF unit	⑥	4	TOF
	2	12	+ 12V				
	3	MXB	Bias for TX MIXer	AF unit	⑥	3	MXB
⑦	1	12	+ 12V				
	2	TIF	TX IF input	IF unit	⑥	3	TIF
	3	G					
	4	300A	300 B +	IF unit	⑬	1	300A
⑧	1	DRB	Control grid bias for V1	AF unit	⑥	5	DRB
	2	RB1	Bias for Q1 RF amp	AF unit	⑥	1	RB1
⑨	1	H	Heater voltage AC 12.3V				
	2	210A	210 B +				
⑩	1	G					
	2	UV	Transverter output	X. VTER socket		7	UV
		NC	Neutralization	Final tank circuit			
		DRV	Drive output	Final unit			DRV
		VCO	VCO input	PLL unit			VCO
		NFB	Negative feed back	Final tank circuit			

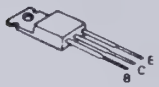
lectifier unit (X43-1370-00)

		HV	High voltage signal to METER	METER SW S13			HV
		800	800 B +				
		300B	300 B +				
		210B	210 B +				
		210A	210 B +				
		STB	Side tone voltage	AF unit			STB
		−C	Common B − Approx. −100V				
		SG2	Screen grid voltage	MODE SW S18-2			SG2
		TUN	Screen grid low voltage for TUN	MODE SW S18-2			TUN
		12	+ 12V				
		SGS	To SG SW	SG SW S20			SGS
		SG1	To MODE SW	MODE SW S18-2			SG1
		PD2	Screen grid voltage	Final unit			SG
		PD1					

SLP-144

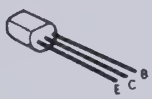
TLR-205

2SA473 (Y)

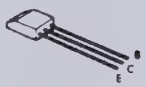


2SA562 (Y)

2SA1015 (Y)
2SC945 (Q)
2SC1515 (K)
2SC1675 (L)
2SC1775 (E)
2SC1815 (BL).(GR).(Y)
2SC1923 (O)
2SC1959 (Y)
2SC2240 (GR)



2SC460 (B)



HA1368R

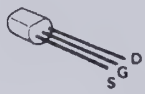
TA7302P

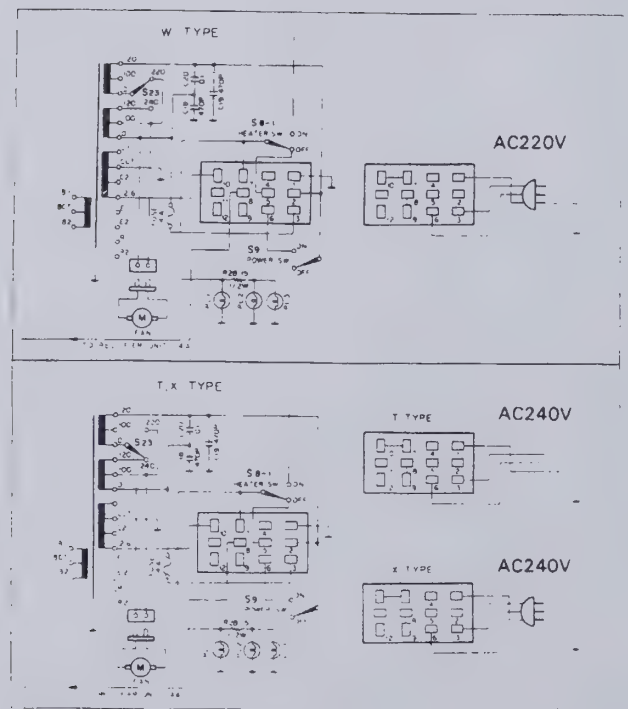
MV-13

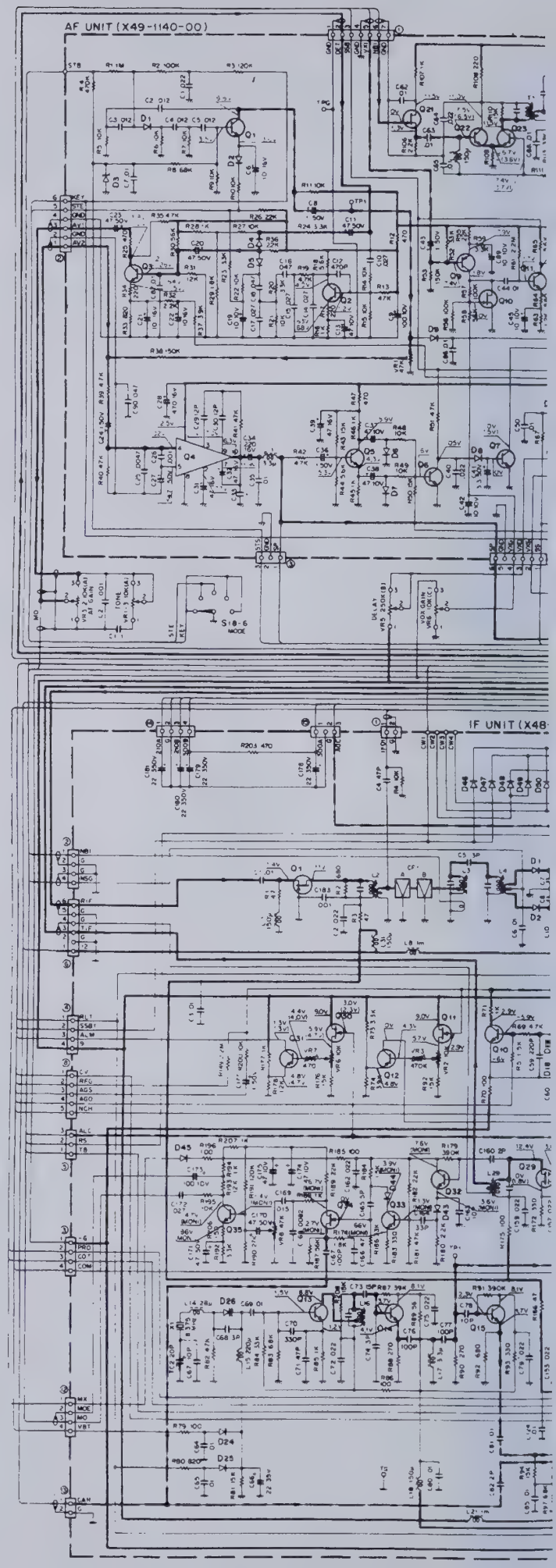
3SK73 (GR)

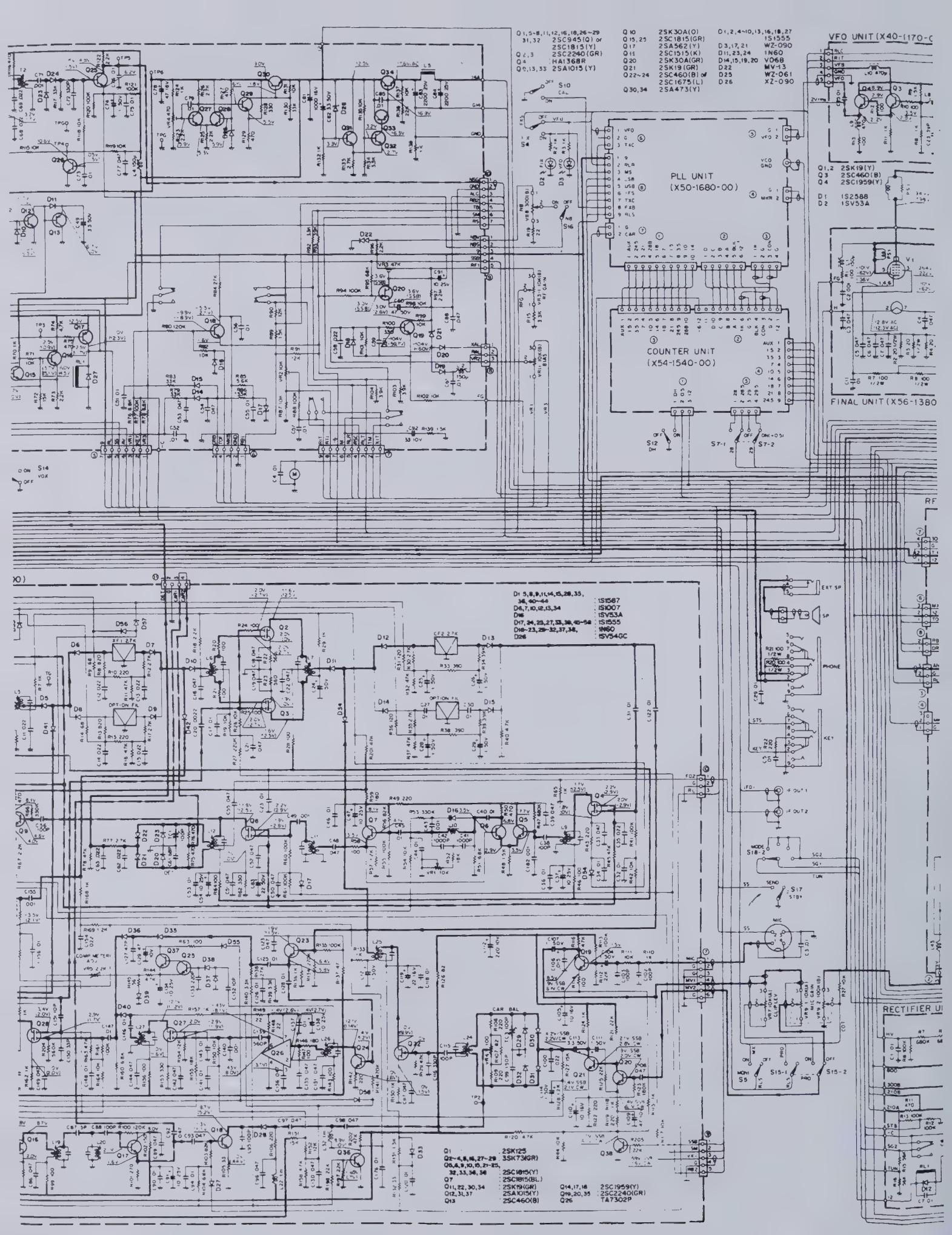
2SK19 (BL).(GR).(Y)

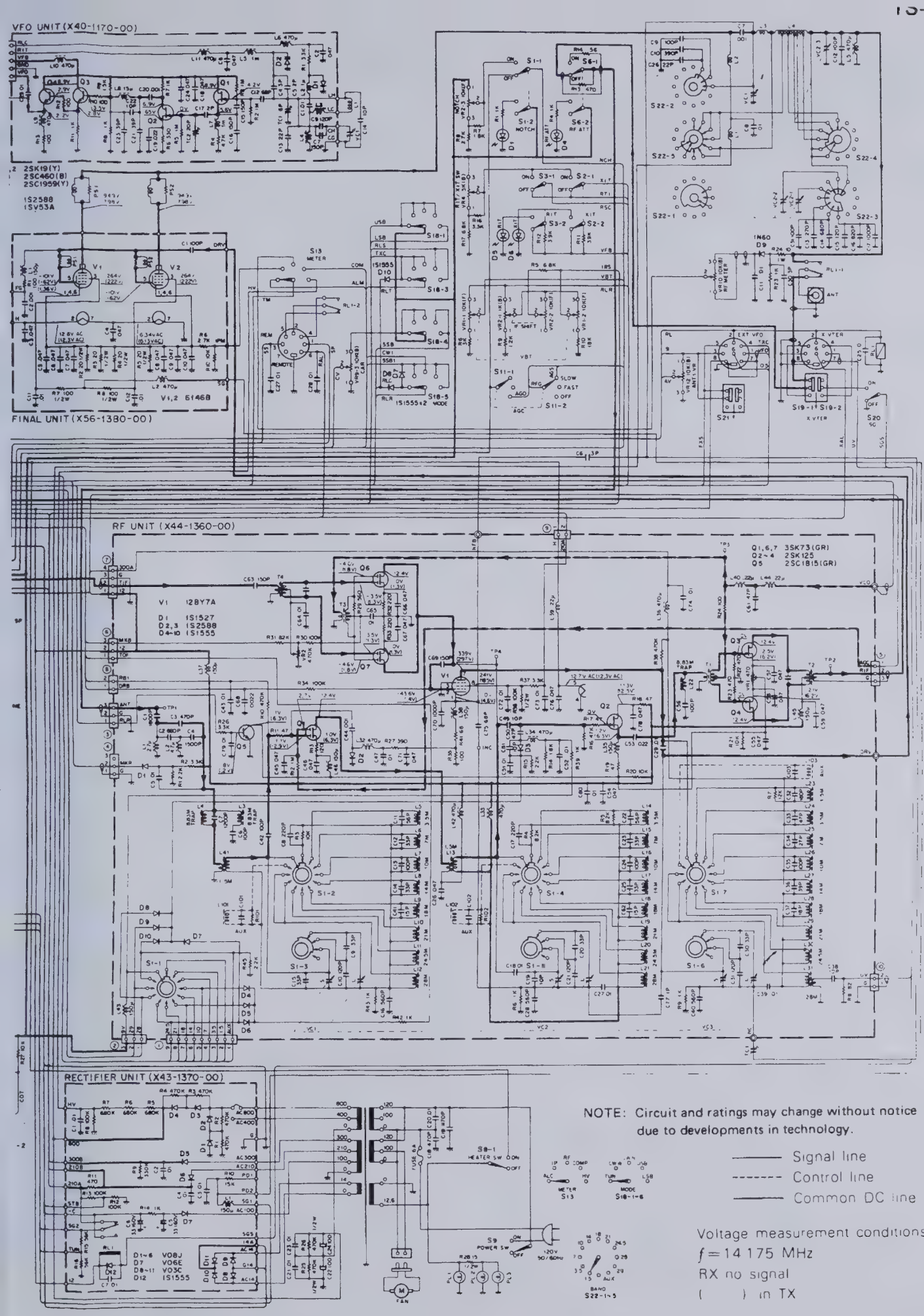
2SK30A (GR) (O)
2SK125

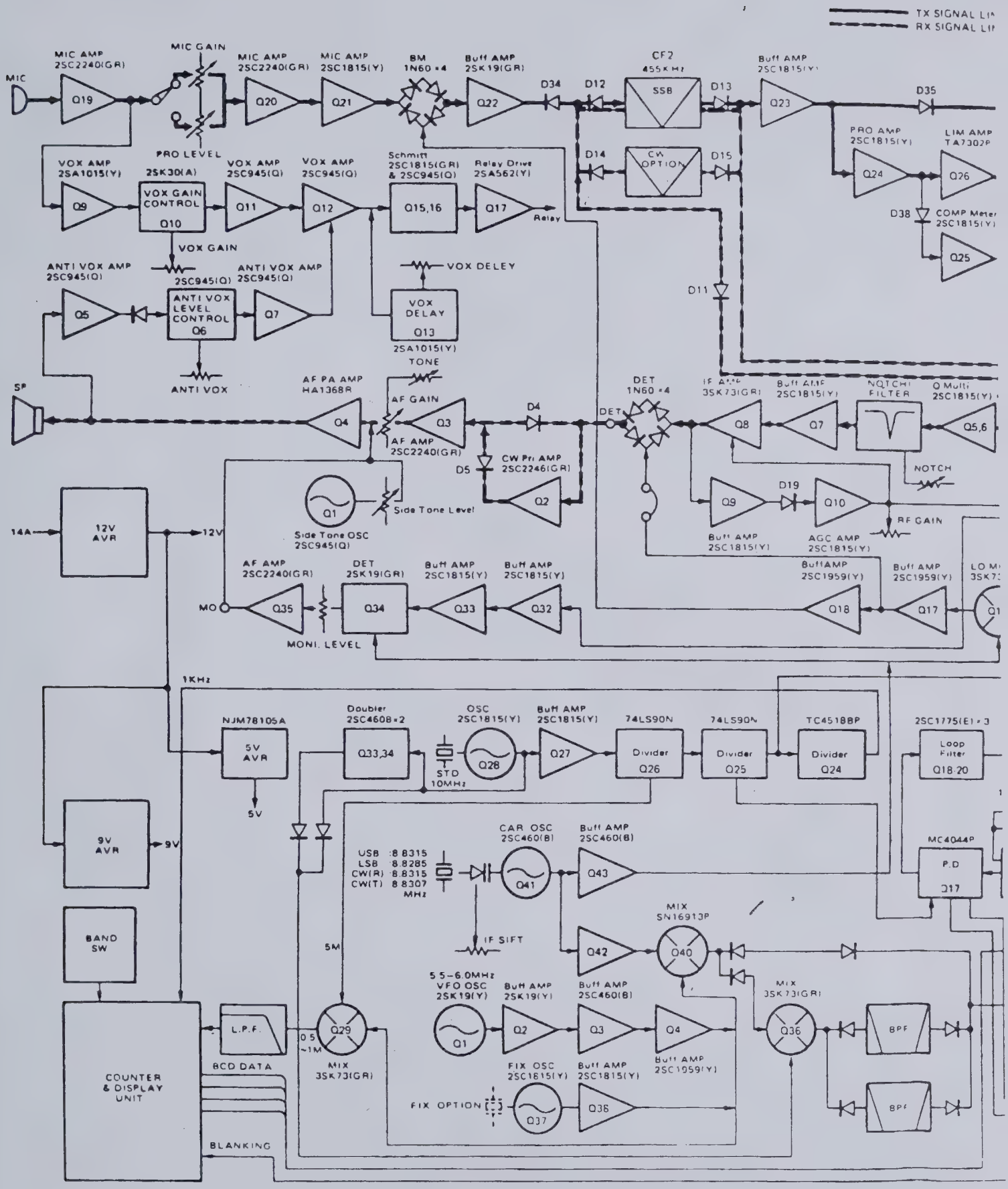




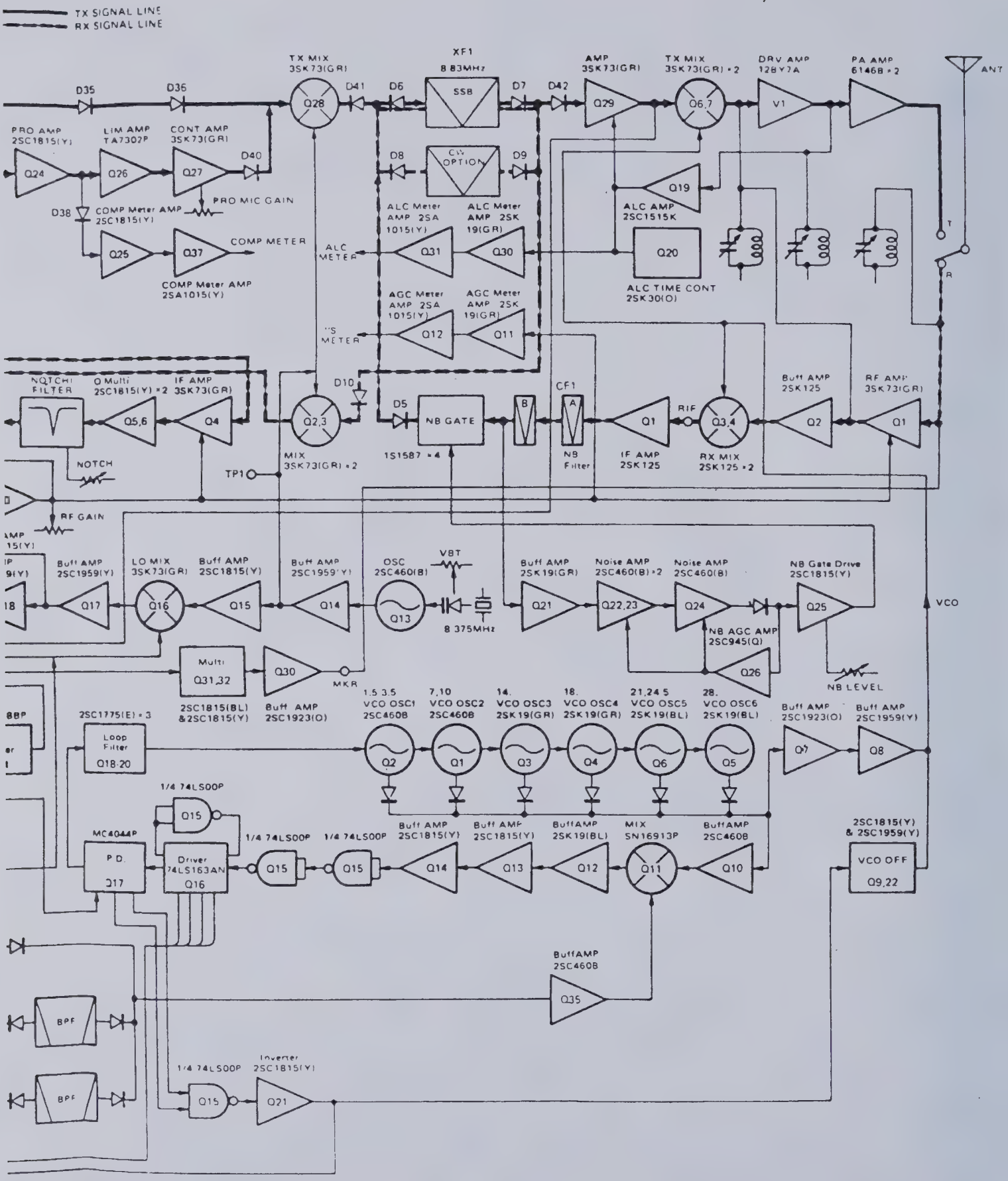


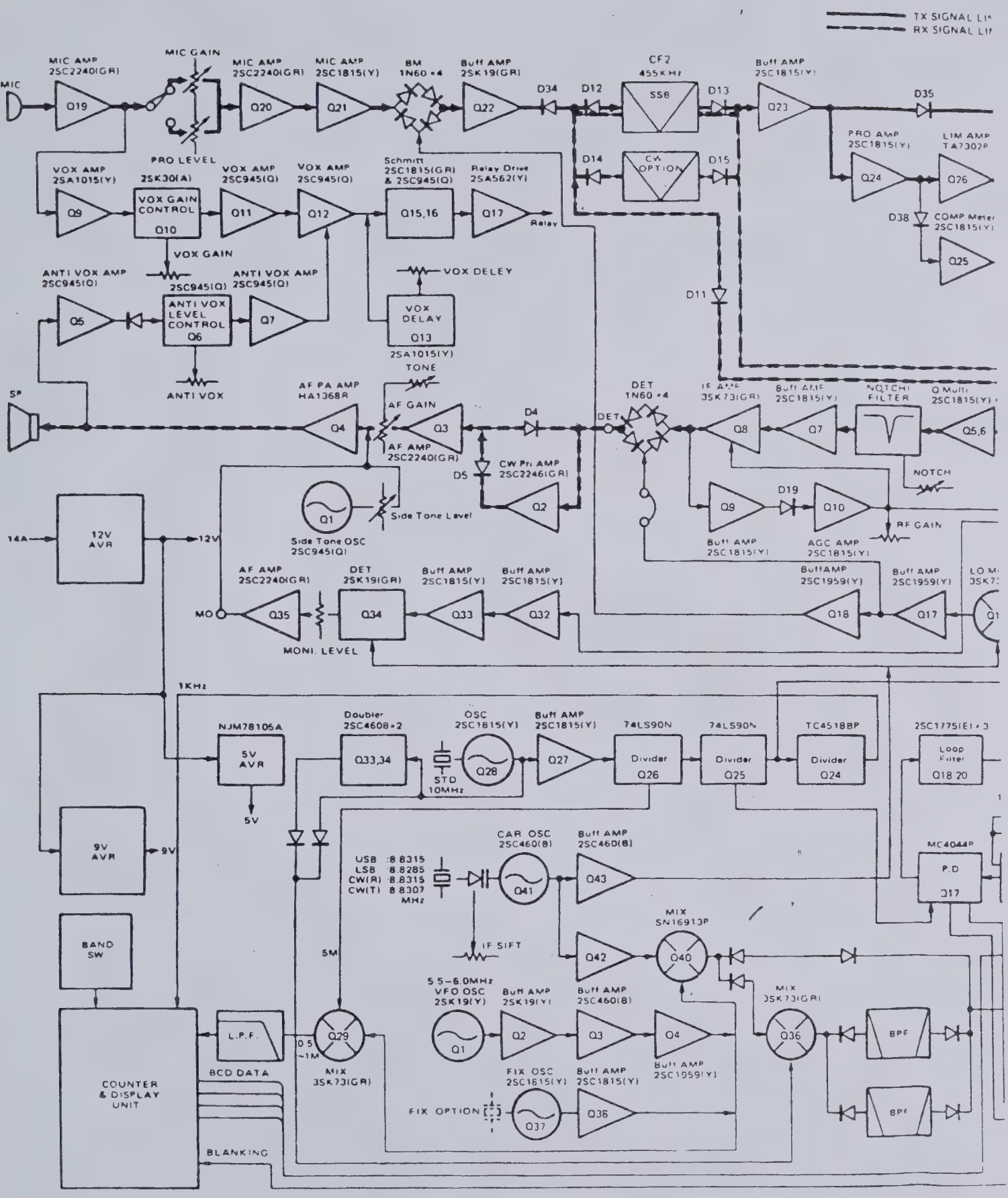

Q1,5~8,11,12,16,18,26~29 31,32 : 2SC945(Q) or 2SC1815(Y)
Q2,3 : 2SC2240(GR)
Q4 : HA1368R
Q9,13,33 : 2SA1015(Y)
Q10 : 2SK30A(O)
Q15,25 : 2SC1815(GR)
Q17 : 2SA562(Y)
Q19 : 2SC1515(K)
Q20 : 2SK30A(GR)
Q21 : 2SK19(GR)
Q22~24 : 2SC460(B) or 2SC1675(L)
Q30,34 : 2SA473(Y)
D1,2,4~10,13,16,18,27 : 1S1555
D3,17,21 : WZ-090
D11,23,24 : 1N60
D14,15,19,20 : V06B
D22 : MV-13
D25 : WZ-061
D26 : XZ-090
VFO UNIT (X40-1170-0
Q1,2 2SK19(Y)
Q3 2SC460(B)
Q4 2SC1959(Y)
D1 1S2588
D2 1SV53A
PLL UNIT (X50-1680-00)
COUNTER UNIT (X54-1540-00)
FINAL UNIT (X56-1380
D1,5,8,9,11,14,15,28,35, 36,40~44 : 1S1587
D6,7,10,12,13,34 : 1S1007
D16 : 1SV53A
D17,24,23,27,33,39,45~58 : 1S1555
D18~23,29~32,37,38, 1N60
D26 : 1SV54GC
Q1 : 2SK125
Q2~4,8,16,27~29 32,33,34,36 : 3SK73(GR)
Q5,6,9,10,20,21~25, : 2SC1815(Y)
Q7 : 2SC1815(BL)
Q11,22,30,34 : 2SK19(GR)
Q12,31,37 : 2SA1015(Y)
Q13 : 2SC460(B)
Q14,17,18 : 2SC1959(Y)
Q19,20,35 : 2SC2240(GR)
Q26 : TA7302P
RECTIFIER U


VFO UNIT (X40-1170-00)
FINAL UNIT (X56-1380-00)
RF UNIT (X44-1360-00)
RECTIFIER UNIT (X43-1370-00)
Q1,6,7 3SK73(GR)
Q2~4 2SK125
Q5 2SC1815(GR)
V1 12BY7A
D1 1S1527
D2,3 1S2588
D4~10 1S1555
NOTE: Circuit and ratings may change without notice due to developments in technology.
Signal line
Control line
Common DC line
Voltage measurement conditions
f = 14 175 MHz
RX no signal
( ) in TX

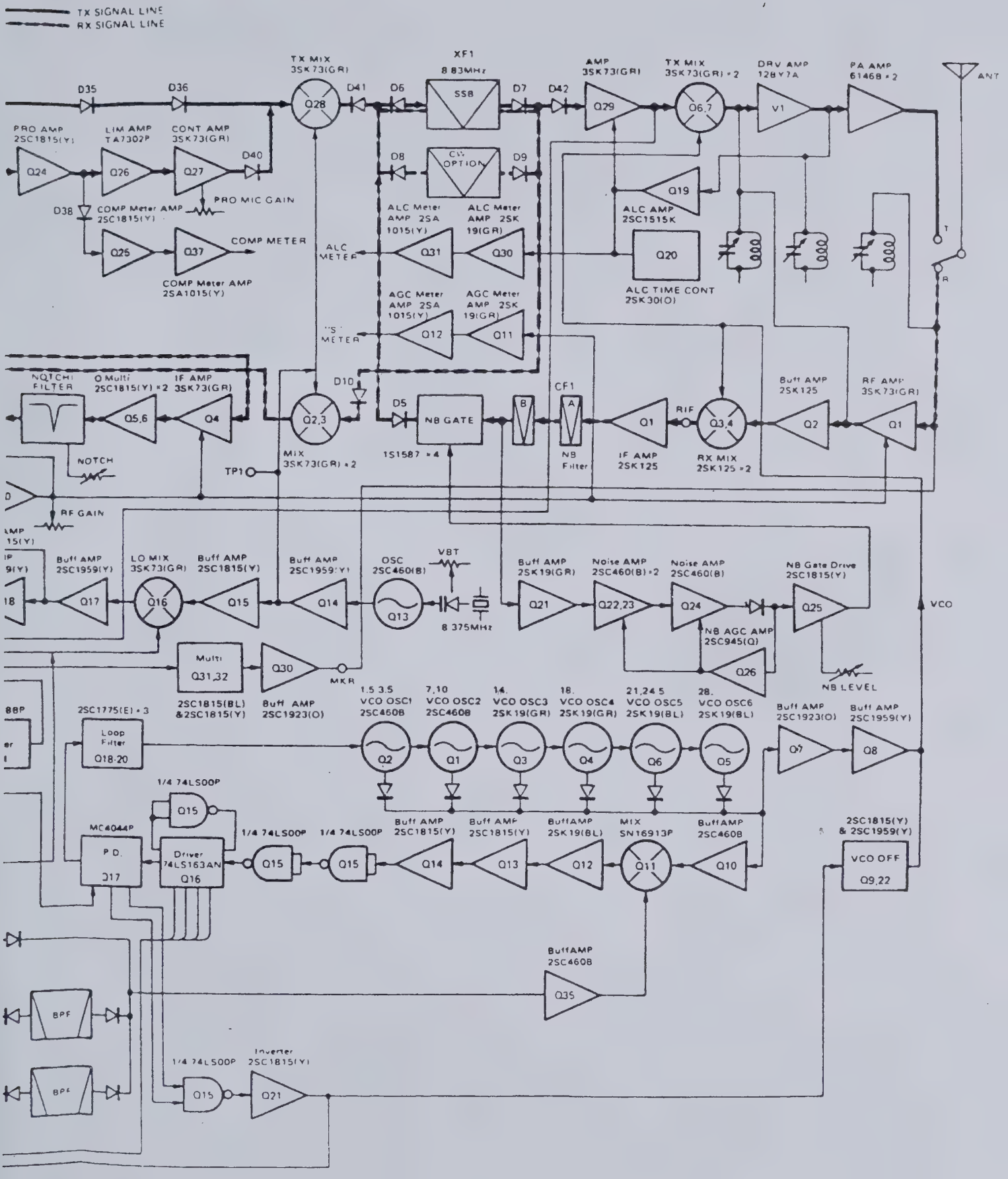

TX SIGNAL LI
RX SIGNAL LI
MIC
MIC AMP 2SC2240(GR)
Q19
MIC GAIN
MIC AMP 2SC2240(GR)
Q20
MIC AMP 2SC1815(Y)
Q21
BM 1N60 ×4
Buff AMP 2SK19(GR)
Q22
D34
D12
CF2 455KHz
SSB
D13
Buff AMP 2SC1815(Y)
Q23
D35
PRO LEVEL
2SK30(A)
D14
CW OPTION
D15
PRO AMP 2SC1815(Y)
Q24
LIM AMP TA7302P
Q26
D38
COMP Meter 2SC1815(Y)
Q25
VOX AMP 2SA1015(Y)
Q9
VOX GAIN CONTROL
Q10
VOX AMP 2SC945(Q)
Q11
VOX AMP 2SC945(Q)
Q12
Schmitt 2SC1815(GR) & 2SC945(Q)
Q15,16
Relay Drive 2SA562(Y)
Q17
Relay
VOX GAIN
2SC945(Q)
ANTI VOX AMP 2SC945(Q)
ANTI VOX AMP 2SC945(Q)
Q5
ANTI VOX LEVEL CONTROL
Q6
Q7
ANTI VOX
VOX DELEY
VOX DELAY
Q13
2SA1015(Y)
D11
TONE
SP
AF PA AMP HA1368R
Q4
AF GAIN
Q3
AF AMP 2SC2240(GR)
D4
DET
DET 1N60 ×4
IF AMP 3SK73(GR)
Buff AMP 2SC1815(Y)
NOTCH FILTER
Q8
Q7
Q5,6
NOTCH
D5
CW Pri AMP 2SC2246(GR)
Q2
Q1
Side Tone Level
Side Tone OSC 2SC945(Q)
Q9
D19
Q10
RF GAIN
Buff AMP 2SC1815(Y)
AGC AMP 2SC1815(Y)
14A
12V AVR
12V
AF AMP 2SC2240(GR)
DET 2SK19(GR)
Buff AMP 2SC1815(Y)
Buff AMP 2SC1815(Y)
Buff AMP 2SC1959(Y)
Buff AMP 2SC1959(Y)
MO
Q35
Q34
Q33
Q32
Q18
Q17
MONI. LEVEL
1KHz
NJM78105A
5V AVR
5V
Doubler 2SC4608×2
Q33,34
OSC 2SC1815(Y)
STD 10MHz
Q28
Buff AMP 2SC1815(Y)
Q27
74LS90N
Divider
Q26
74LS90N
Divider
Q25
TC4518BP
Divider
Q24
2SC1775(E)×3
Loop Filter
Q18-20
9V AVR
9V
CAR OSC 2SC460(B)
Buff AMP 2SC460(B)
USB 8.8315
LSB 8.8285
CW(R) 8.8315
CW(T) 8.8307
MHz
Q41
Q43
MC4044P
P.D
Q17
MIX SN16913P
IF SIFT
Q42
Q40
BAND SW
5M
5.5~6.0MHz VFO OSC 2SK19(Y)
Buff AMP 2SK19(Y)
Buff AMP 2SC460(B)
MIX 3SK73(GR)
Q1
Q2
Q3
Q4
Q36
BPF
BPF
L.P.F.
0.5 ~1M
Q29
MIX 3SK73(GR)
FIX OSC 2SC1815(Y)
Buff AMP 2SC1815(Y)
Buff AMP 2SC1959(Y)
FIX OPTION
Q37
Q38
BCD DATA
COUNTER & DISPLAY UNIT
BLANKING

330S BLOCK DIAGRAM

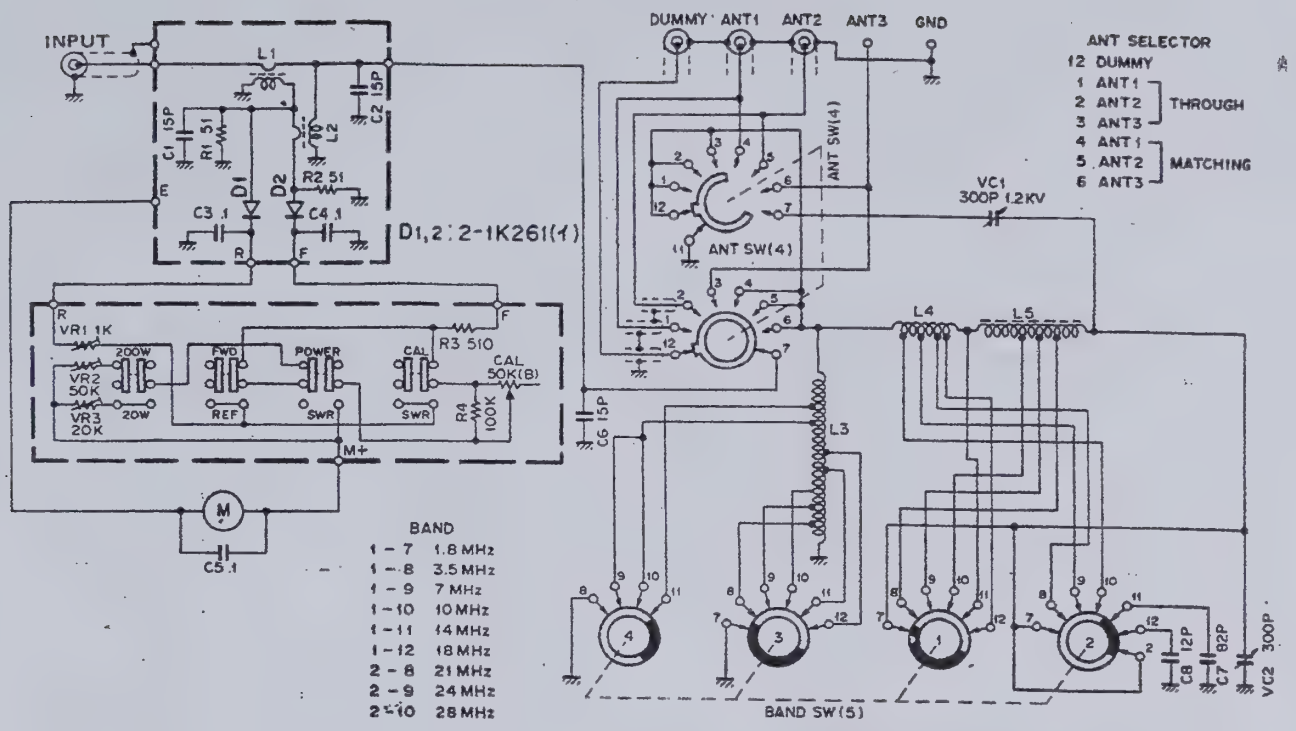



TX SIGNAL LI
RX SIGNAL LI
MIC
MIC AMP 2SC2240(GR)
Q19
MIC GAIN
PRO LEVEL
MIC AMP 2SC2240(GR)
Q20
MIC AMP 2SC1815(Y)
Q21
BM 1N60 ×4
Buff AMP 2SK19(GR)
Q22
D34
D12
CF2 455KHz
SSB
D13
Buff AMP 2SC1815(Y)
Q23
D35
PRO AMP 2SC1815(Y)
Q24
LIM AMP TA7302P
Q76
D38
COMP Meter 2SC1815(Y)
Q25
D14
CW OPTION
D15
D11
VOX AMP 2SA1015(Y)
Q9
2SK30(A)
VOX GAIN CONTROL
Q10
VOX AMP 2SC945(Q)
Q11
VOX AMP 2SC945(Q)
Q12
Schmitt 2SC1815(GR) & 2SC945(Q)
Q15,16
Relay Drive 2SA562(Y)
Q17
Relay
VOX GAIN
2SC945(Q)
VOX DELEY
VOX DELAY
Q13
2SA1015(Y)
ANTI VOX AMP 2SC945(Q)
Q5
ANTI VOX LEVEL CONTROL
Q6
ANTI VOX AMP 2SC945(Q)
Q7
ANTI VOX
TONE
SP
AF PA AMP HA1368R
Q4
AF GAIN
Q3
AF AMP 2SC2240(GR)
D4
DET
DET 1N60 ×4
IF AMP 3SK73(GR)
Q8
Buff AMP 2SC1815(Y)
Q7
NOTCH FILTER
Q Multi 2SC1815(Y)
Q5,6
NOTCH
D5
CW Pri AMP 2SC2246(GR)
Q2
Side Tone Level
Q1
Side Tone OSC 2SC945(Q)
14A
12V AVR
12V
Q9
D19
Q10
RF GAIN
Buff AMP 2SC1815(Y)
AGC AMP 2SC1815(Y)
MO
AF AMP 2SC2240(GR)
Q35
DET 2SK19(GR)
Q34
Buff AMP 2SC1815(Y)
Q33
Buff AMP 2SC1815(Y)
Q32
MONI. LEVEL
BuffAMP 2SC1959(Y)
Q18
Buff AMP 2SC1959(Y)
Q17
1KHz
NJM78105A
5V AVR
5V
Doubler 2SC4608×2
Q33,34
OSC 2SC1815(Y)
STD 10MHz
Q28
Buff AMP 2SC1815(Y)
Q27
74LS90N
Divider
Q26
74LS90N
Divider
Q25
TC4518BP
Divider
Q24
2SC1775(E)×3
Loop Filter
Q18 20
9V AVR
9V
CAR OSC 2SC460(B)
Q41
Buff AMP 2SC460(B)
Q43
USB 8.8315
LSB 8.8285
CW(R) 8.8315
CW(T) 8.8307
MHz
MC4044P
P.D
Q17
BAND SW
IF SIFT
Q42
MIX SN16913P
Q40
5M
5.5–6.0MHz VFO OSC 2SK19(Y)
Q1
Buff AMP 2SK19(Y)
Q2
Buff AMP 2SC460(B)
Q3
Q4
Buff AMP 2SC1959(Y)
MIX 3SK73(GR)
Q36
BPF
BPF
L.P.F.
0.5 ~1M
Q29
MIX 3SK73(GR)
BCD DATA
COUNTER & DISPLAY UNIT
FIX OSC 2SC1815(Y)
Buff AMP 2SC1815(Y)
FIX OPTION
Q37
Q38
BLANKING

330S BLOCK DIAGRAM



AT-230



SPECIFICATIONS

ANTENNA COUPLER

Frequency Range	9 amateur bands from 1.8 to 29.7 MHz
Input Impedance	50Ω
Output Impedance	10 to 500Ω, unbalanced
Through Power	200W at max.
Insertion Loss	Less than 0.5 dB in matched state
Pi-L	1.8 MHz only
Output Impedance	20 to 500Ω, unbalanced
Through Power	100W at max.

WATTMETER

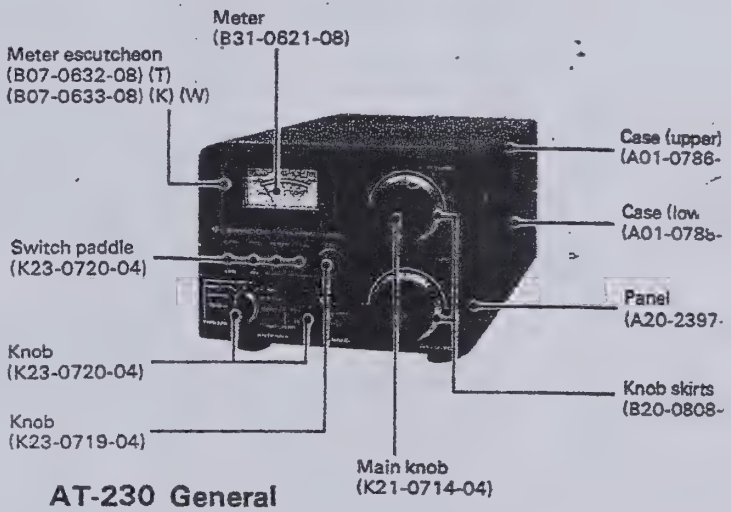
Type	Through-line wattmeter
Frequency Range	1.8 to 30 MHz
Measurable RF Power	Up to 20/200W, switched
Kinds of RF Power	Forward or reflected power, switched.
Net weight	3.4 kg (7.5 lbs.) approx.
Impedance	50Ω
Accuracy	Better than ±10% of full scale

SWR METER

SWR Detection	Toroid core direction coupler
Measurable Range	1.1 to 10
Min. Power Required	4W

GENERAL

Connectors	
INPUT	UHF type, 50Ω
ANT-1	UHF type
ANT-2	UHF type
ANT-3	Stud and wing nut
Dimensions	W 180 mm (7-3/32″)
	H 133 mm (5-15/64″)
	D 288 mm (11-11/32″)



AT-230 General

Ref. No.	Parts No.	Description	Remarks
	A01-0786-03	Case (upper)	☆
	A01-0788-02	Case (lower)	☆
	A20-2397-02	Panel	☆
	B07-0632-08	Meter escutcheon (T)	☆
	B07-0633-08	Meter escutcheon (K)(W)	☆
	B20-0808-04	Knob skirt	
	B31-0621-08	Meter	
	B46-0058-00	Warranty card (K)	
	B50-2756-08	Operating manual (K)(W)	☆
	B50-2757-08	Operating manual (T)	☆
VC1, 2	C02-0016-08	Variable cap 300pF 1.2kV	
C7	C91-0419-05	C 82pF 3kV	☆
C8	C91-0402-05	C 12pF 3kV	☆
	D23-0061-04	Bearing	

Ref. No.	Parts No.	Description	Remarks
	E04-0102-05	UHF type receptacle	
	E23-0015-04	Gnd lug φ3	
	E23-0408-05	Terminal	
	F09-0402-05	Insulating cover	
	F29-0402-08	Insulator	
	G13-0621-04	Cushion	
	H01-2714-04	Carton case (inside)(K)(W)	☆
	H01-2715-04	Carton case (inside)(T)	☆
	H10-2525-02	Packing fixture (R)	☆
	H10-2545-02	Packing fixture (F)	☆
	J02-0049-14	Foot (large)	
	J32-1030-04	Round boss	
	K21-0715-04	Main knob R, X Tune	
	K21-0745-08	Knob, BAND, ANT	
	K23-0719-04	Knob, CAL	
	K23-0720-04	Switch paddle	
L3	L34-0992-08	Coil	☆
L4	L34-0993-08	Coil	☆
L5	L34-0994-08	Coil	☆
	N14-0506-08	Wing nut, M5 ANT3, GND	
	S01-2418-08	Rotary switch, ANT	
	S01-5404-08	Rotary switch, BAND	☆
	W02-0302-08	Switch module	
	W02-0303-08	Detector module	

Switch module (W02-0302-08)

Ref. No.	Parts No.	Description	Remarks
VR1	R12-1024-05	Trim. pot 1kΩ (B)	
VR2	R12-4020-05	Trim. pot 50kΩ (B)	
VR3	R12-3420-08	Trim. pot 20kΩ (B)	
VR4	R05-3407-08	Pot. 50kΩ (B) CAL	
R3	RD14BB2E511J	Carbon resistor 510Ω ±5% 1/4W	
R4	RD14BB2E104J	Carbon resistor 100kΩ ±5% 1/4W	
	S36-2026-15	Paddle switch × 4	

Detector module (W02-0303-08)

Ref. No.	Parts No.	Description	Remarks
C1, 2	FM05ZC150J5	Mica 15pF 500V	
C6	FM05ZC150J5	Mica 15pF 500V	
R1, 2	RD14BB2E510J	Carbon resistor 51Ω ±5% 1/4W	
D1, 2	V11-7763-26	Diode 2-1K261 × 2	
L1, 2	L39-0403-08	Detector coil	

1. INSTRUMENTS

1) Terminated Power Meter

1. Frequency range: 50 MHz or more
2. Input impedance: 50Ω
3. Power range: 20W and 200W

2) HF Transmitter or Transceiver

1) Output: 100W CW
Variable to 10W.
Example: TS-830, TS-820S

2. POWER METER ADJUSTMENT

1) Test Equipment Connection

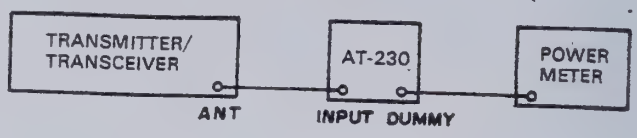


Fig. 1

2) Adjustment

1. Connect as in Fig. 1.
2. Unless otherwise specified, controls should be set as follows:

ANT SW	DUMMY
BAND SW	14
200W/20W SW	200W
FWD/REF SW	FWD
POWER/SWR SW	POWER
CAL/SWR SW	SWR

Tune up the transceiver at 14.175 MHz.

3. Adjust the transceiver for 100W output at the power meter (adjusted by the carrier level control).
Adjust VR2 on the switch unit for a meter reading of 100 on the AT-230.

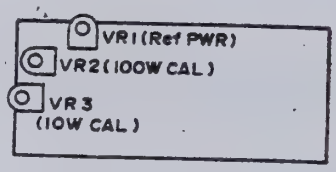


Fig. 2

4. As in step 3, lower transceiver output to 10W and adjust VR3 for a meter indication of 10 on the 20W scale.

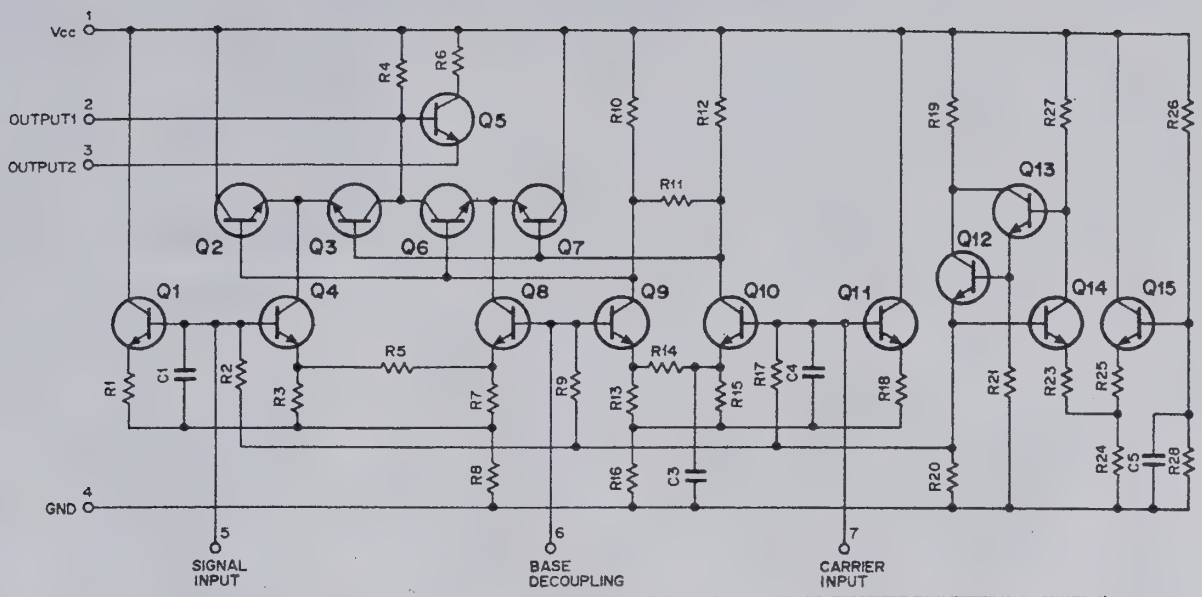
3. CALIBRATION OF REF POWER

1) Connection

As in Fig. 1.

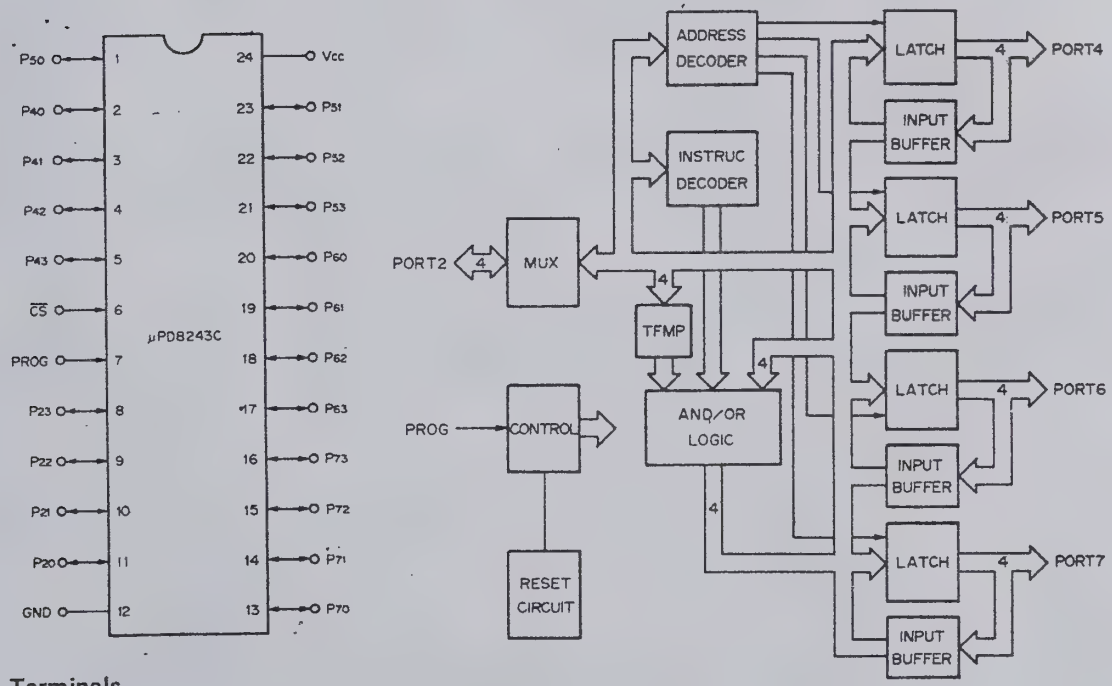
2) Adjustment

1. Set controls as described in 2.2.
Confirm 100W CW output reading.
2. Unkey the transceiver and reverse the coaxial cable between the INPUT and DUMMY terminals on the AT-230. Move the FWD/REF switch to the REF position.
3. Transmit and adjust VR1 for previously confirmed 100W reading.



Item	Symbol	Rating
Operating voltage	Vcc	9.0V
Dissipation	Pd	270 mW (Ta= 75°C)
Operating temperature	Topt	−30～+75°C
Storage temperature	Tstg	−40～+125°C

Fig. 14 μPC1037H Double Balanced Modulator (DIGITAL UNIT, IC14)



Terminals

P_{20}～P_{23}	: Input Output (Port 2)
P_{40}～P_{43}	: Input Output port (Port 4)
P_{50}～P_{53}	: Input Output port (Port 5)
P_{60}～P_{63}	: Input Output port (Port 6)
P_{70}～P_{73}	: Input Output port (Port 7)
$\overline{CS}$	: Chip Select
PROG	: Program pulse
	Input Output port (Port 2)

Maximum Rating (Ta=25°C)

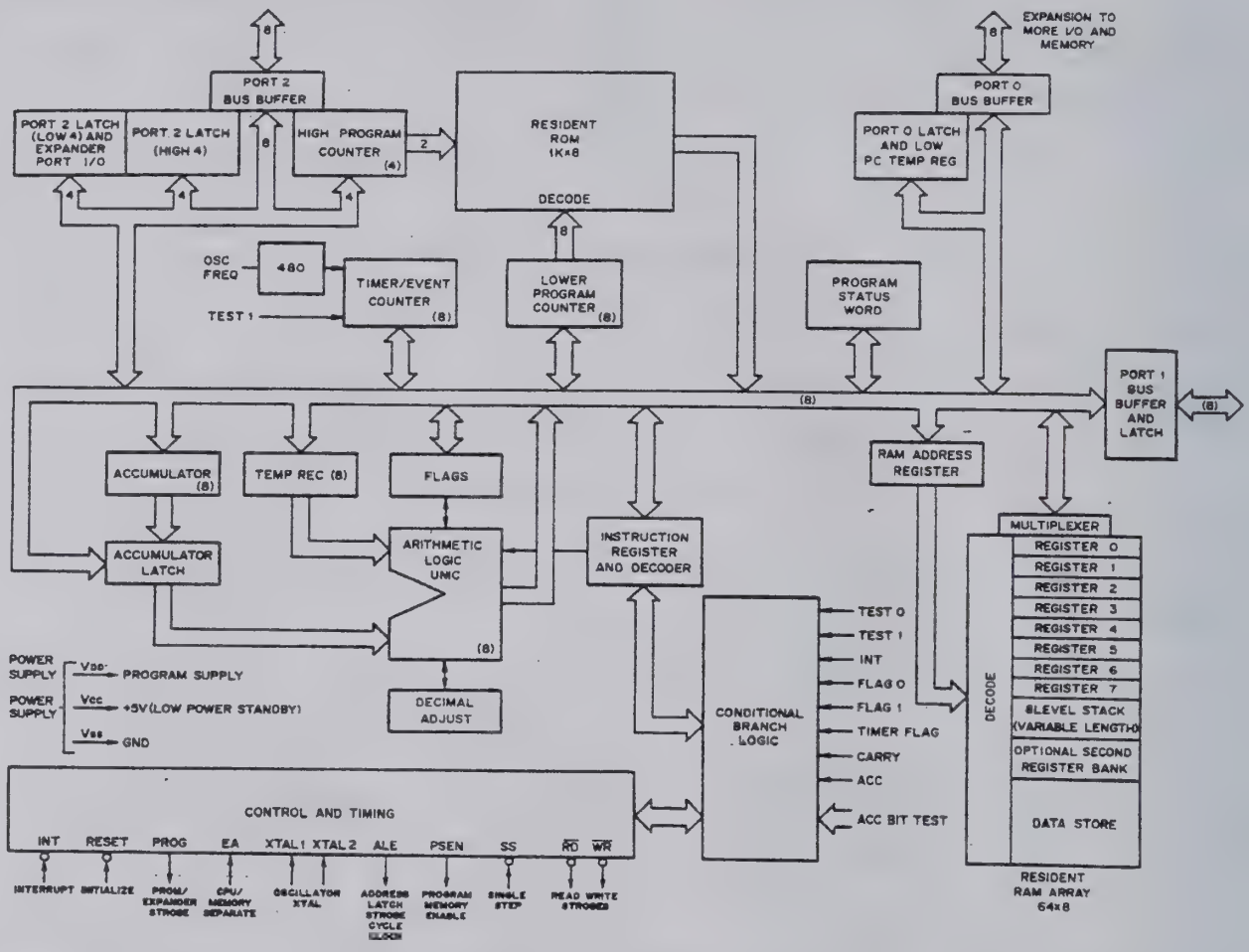
Item	Symbol	Rating
Operating voltage	Vcc	−0.5～+7V
Input voltage	Vi	−0.5～+7V
Output voltage	Vo	−0.5～+7V
Operating temperature	Topt	0～+70°C
Storage temperature	Tstg	−60～+150°C

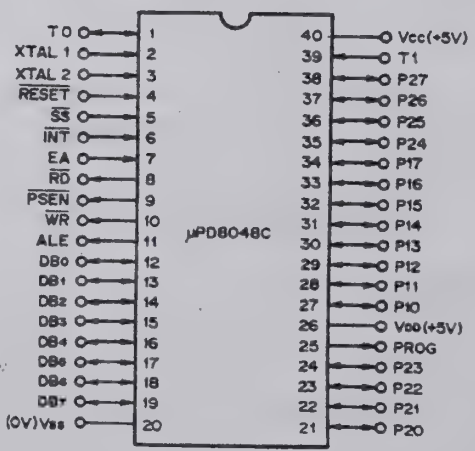
Fig. 15 μPD8243C (DIGITAL UNIT, IC10, 17)

The frequency display resolution is identical to that of the main unit (down to 100 Hz) except for the RIT and CW transmission frequency display. This is accomplished by dynamically driving the fluorescent display tube based on the display and column data furnished by the microprocessor. The power to the VFO-230 is interlocked with that of the main unit. If, however, the VFO-230 is plugged into an AC outlet, the display, memory and output of the VFO remain live even when the power switch on the main unit is OFF. Therefore, when the main unit is again powered-on, the operating state set prior to power-off will reappear. Back-up power consumption for the VFO-230 is approximately 10 mA at 5V.

Item	Rating
Center frequency	470 kHz
6 dB bandwidth	±12.5 kHz or more
50 dB bandwidth	±25 kHz or less
Ripple (within 455±8 kHz)	3 dB or less
Loss	4 dB or less
Guaranteed attenuation	35 dB or less within 455±100 kHz
Input and output impedance	1.5 kΩ

Fig. 11 Ceramic filter (L71-0321-05) CFW470C (DIGITAL UNIT, CF 1)





Terminals

P10～P17	:	Input and output port (PORT 1)
P20～P27	:	Input and output port (PORT 2)
DB_0～DB_7	:	Data bus
T0, T1	:	Test
$\overline{INT}$	:	Interrupt
$\overline{RD}$	:	Read
$\overline{WR}$	:	Write
ALE	:	Address latch enable
$\overline{PSEN}$	:	Program store enable
$\overline{RESET}$	:	Reset
$\overline{SS}$	:	Single step
EA	:	External access
XTAL 1, 2	:	Crystal input

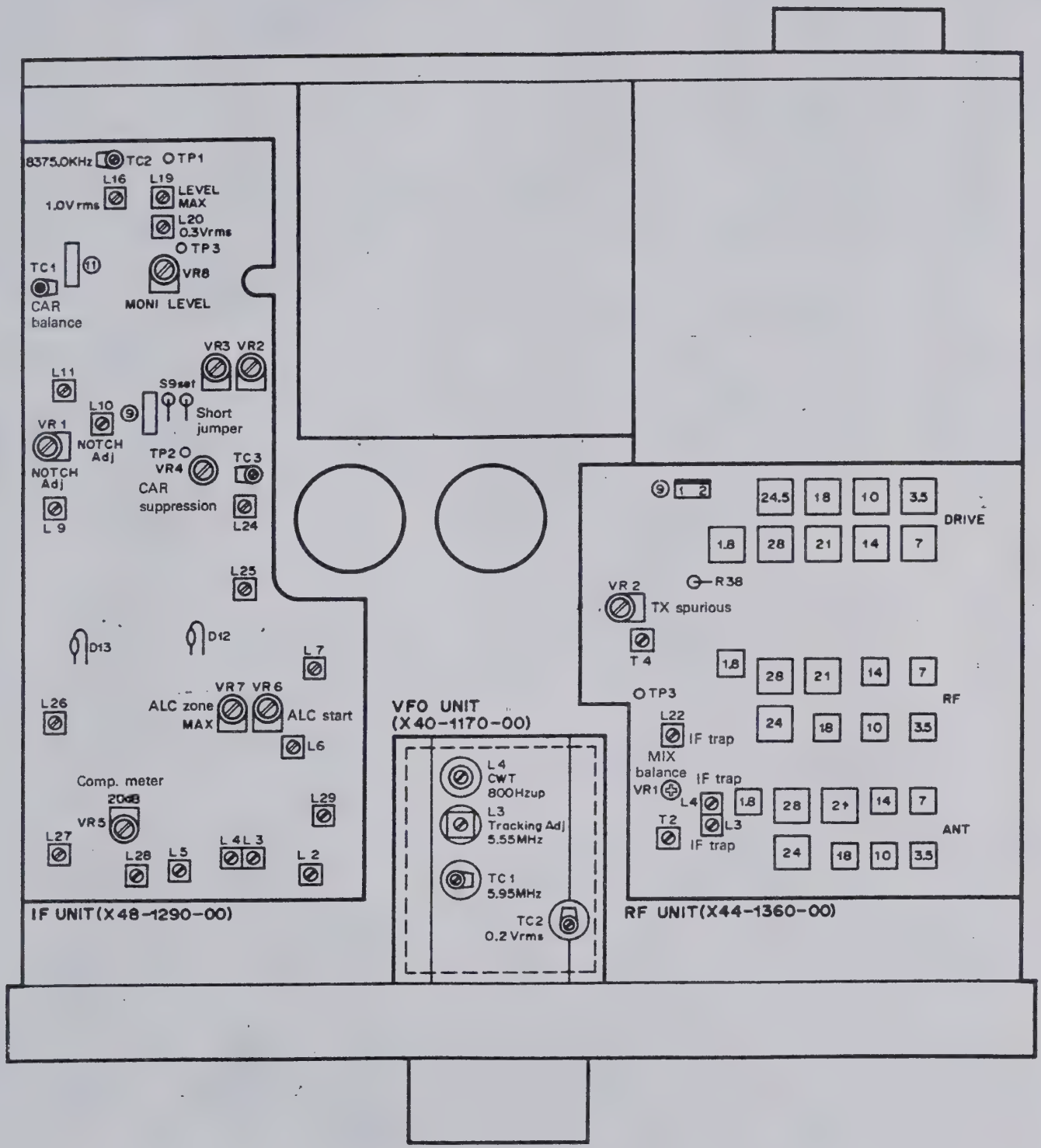
Maximum rating (Ta = 25°C)

Item	Symbol	Rating
Operating voltage	Vcc	−0.5～+7.0V
	VDD	−0.5～+7.0V
Input voltage	Vi	−0.5～+7.0V
Output voltage	Vo	−0.5～+7.0V
Operating temperature	Topt	0～+70°C
Storage temperature	Tstg	−65～+150°C

Fig. 13 μPD8048C-155 (DIGITAL UNIT, IC11)

LOCATION OF ADJUSTMENTS

▼ TOP VIEW



Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	Connect a power meter to the ANT terminal. SG SW ON STBY SEND Tune up MODE USB Connect the AG (1 kHz, 10 mV) to the MIC jack. METER ALC Deflect ALC meter by MIC GAIN control. MONI ON				IF	VR8	Monitor output 0.63V/8Ω.		
	Disconnect AG. AF GAIN MAX.							Less than 8mV/8Ω	Monitor hum
	MONI OFF, STBY REC								

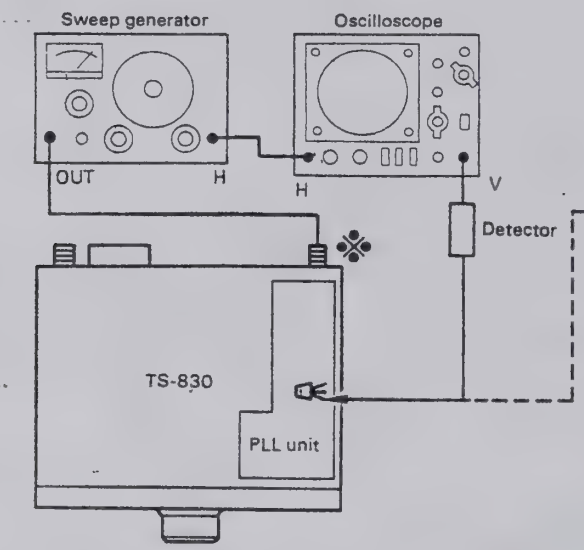


Fig. 9
(10) BPF-A, (11) BPF-B, (12) BPF-C
(13) VFO MIX SPURIOUS

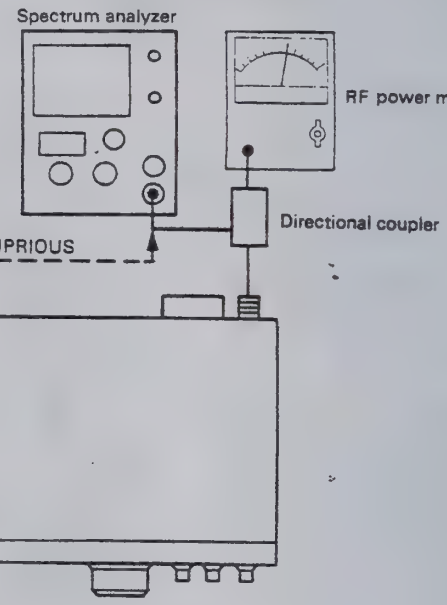


Fig. 10 (27) TX SPURIOUS

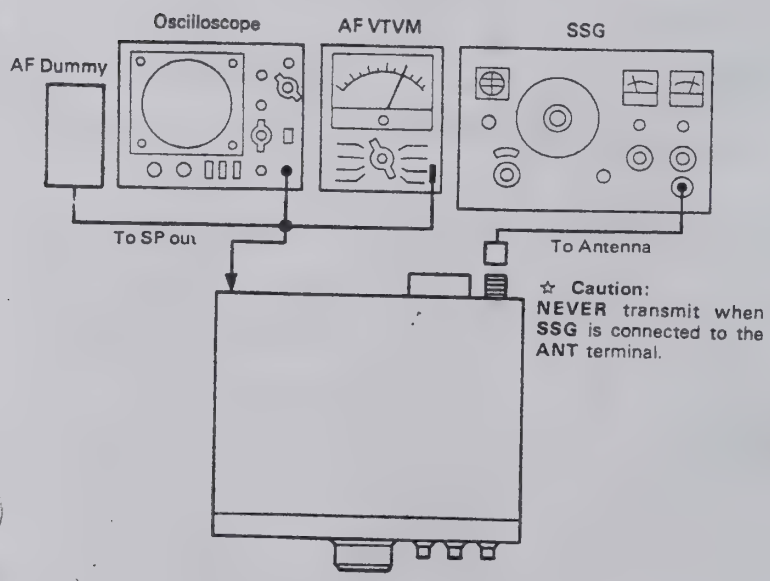


Fig. 12 (15) IF AMP, (16) COIL PACK, (20) IF TRAP,

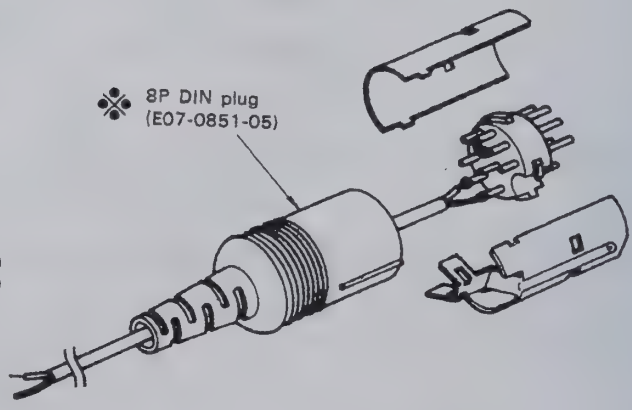
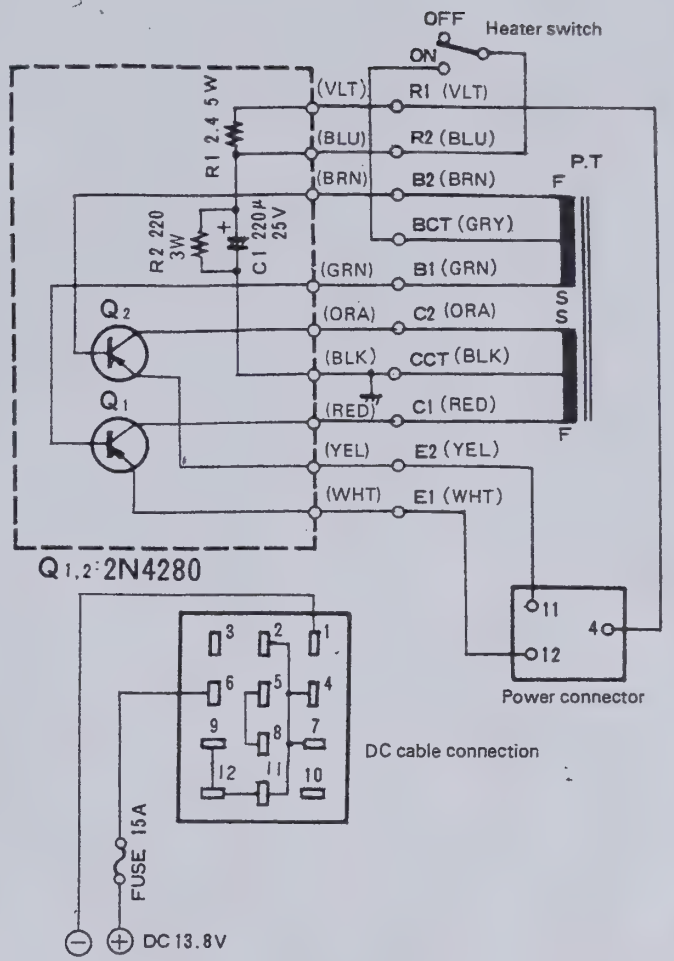


Fig. 11 8P DIN connector

DS-2 (W type only)

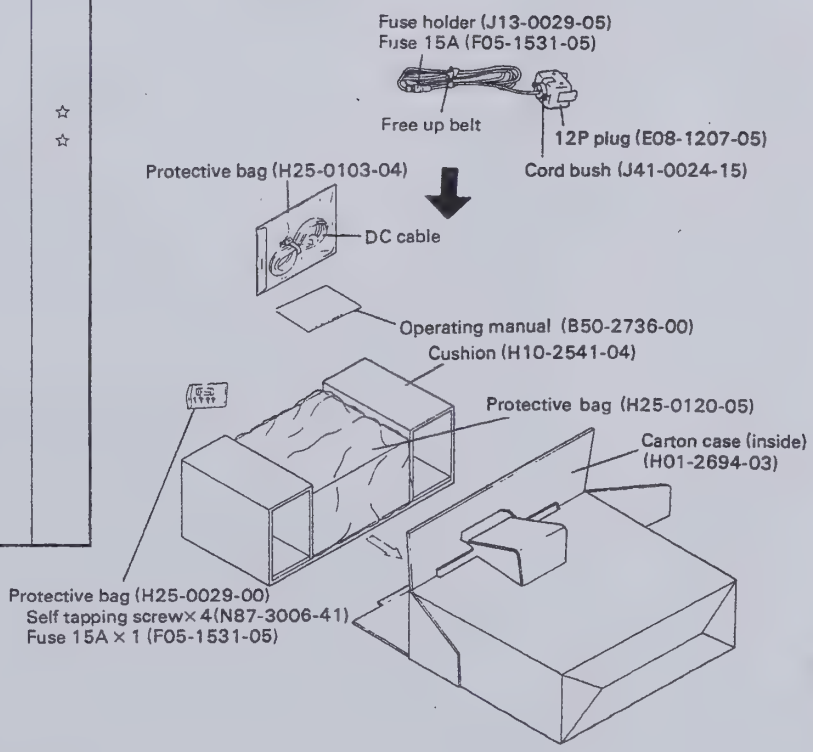
SPECIFICATIONS

Semiconductor..... 2N4280 × 2
Rated Final Stage Input
Power at 13.8 VDC.
  SSB..... 130W PEP
  CW..... 100W
Power Consumption
  Receive:
  Heaters OFF..... 0.8A
  Heaters ON..... 4.5A
  Transmit..... 15A
Power Supply..... 12—16 VDC (standard: 13.8V)
Dimensions ..... W 80 mm (3.15″)
  H 37 mm (1.46″)
  D 69 mm (2.72″)
Weight 240g

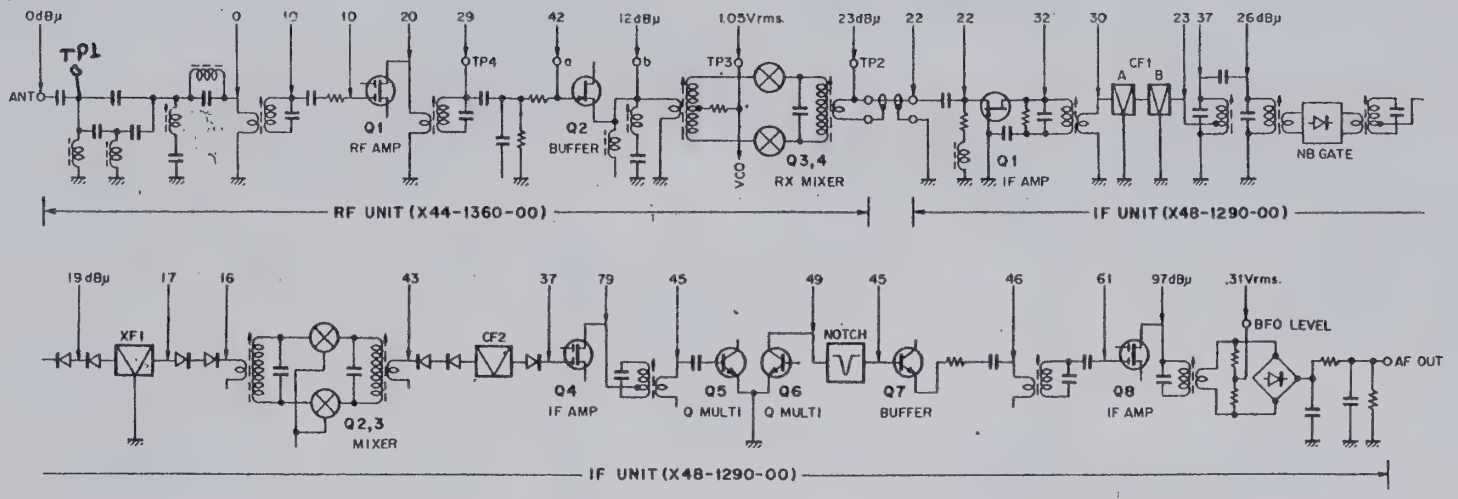


PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
	B50-2736-00	Operating manual	☆
C1	CE02W1E221	C 220μF 25V	
	E08-1207-05	12P plug	
	E20-0513-05	5P terminal	
	F05-1531-05	Fuse 15A	
	F29-0414-04	Insulating washer	
	H01-2694-03	Carton case (inside)	☆
	H10-2541-04	Cushion	☆
	H25-0029-04	Protective bag	
	H25-0103-04	Protective bag	
	H25-0120-04	Protective bag	
	J13-0029-05	Fuse holder	
	J41-0024-15	Cord bush	
R1	R92-0121-05	Cement resistor 2.4Ω 5W	
R2	R92-0120-05	Cement resistor 220Ω 2.5W	
Q1, 2	V30-1161-06	TR 2N4280	



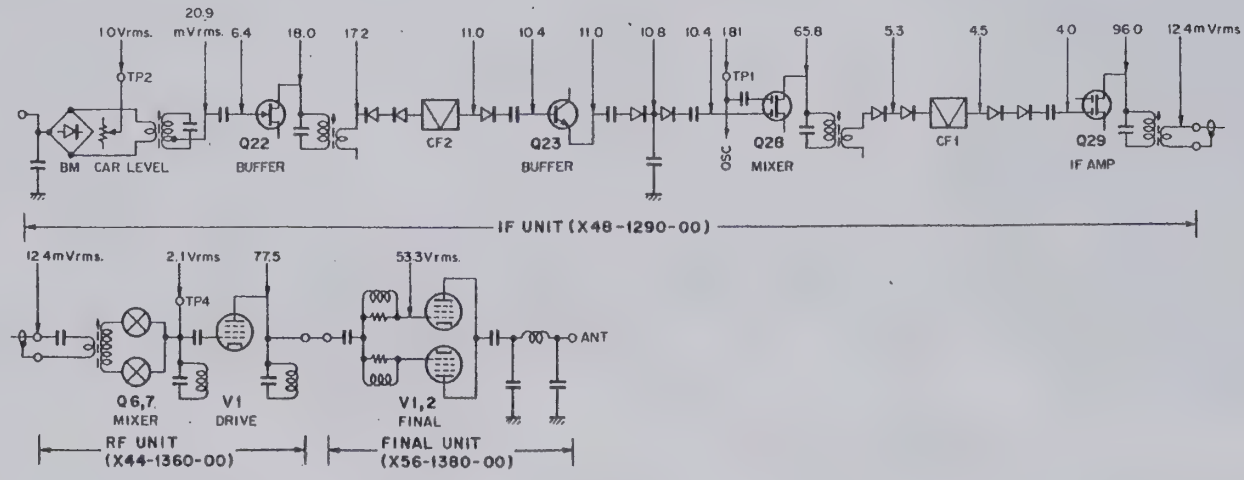
<RX Section>



NOTES:

1. The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting and AGC SW OFF. Set the AF gain control for 0.63/8Ω (50 mW) audio output 0 dB signal generator input at 14.2 MHz.
2. To inject signal generator output connect a 0.01μF 500V capacitor between the signal generator and the check point.
3. To check the level at point a, the secondary ANT coil is grounded.

<TX Section>

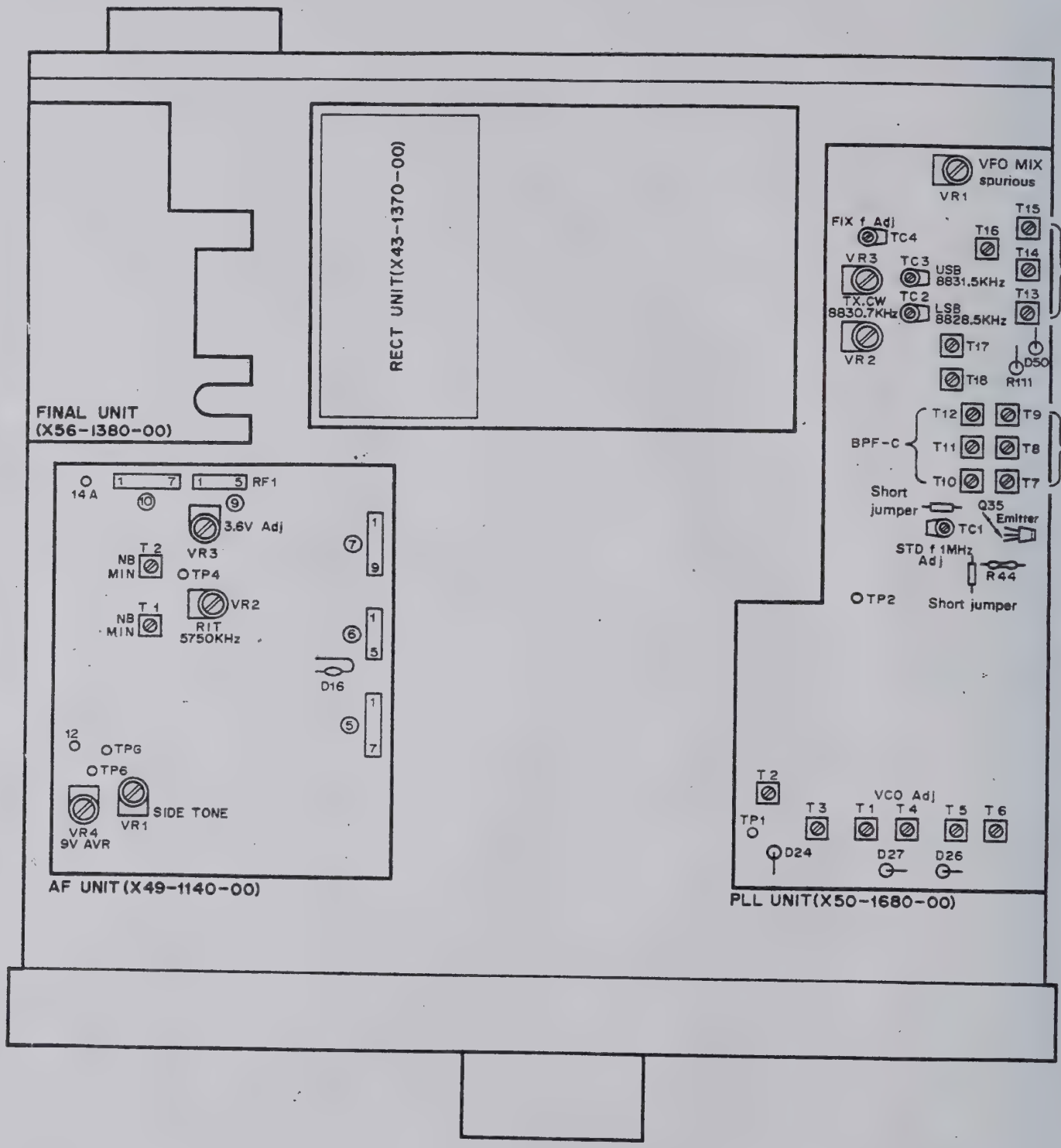


NOTES:

1. Levels are measured at 14.2 MHz in the CW MODE and SG SW OFF. Carrier level is adjusted until the meter indicates the maximum on-scale ALC reading.
2. All voltage measurements are read from an RF VTVM.
3. A probe with a capacitance of less than 3PF should be used, and the ground should be made near the point of measurement.

LOCATION OF ADJUSTMENTS

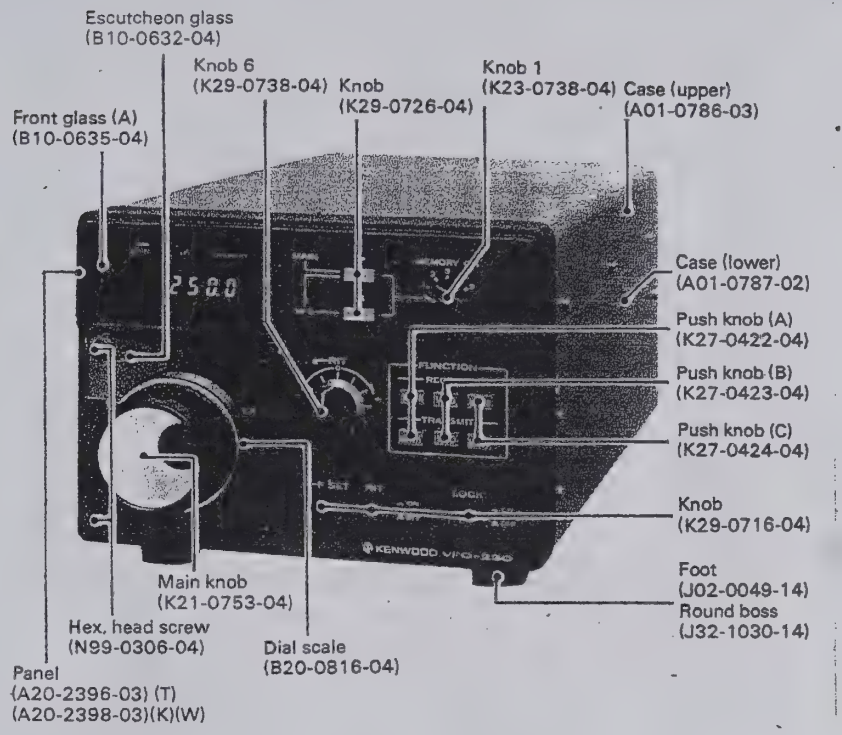
▼ BOTTOM VIEW



VFO-230

SPECIFICATIONS

Oscillation frequency ...	5.40 ~ 6.10 MHz	
put voltage	0.2V $^{+3}_{-1}$ dB	
rrequency stability	Within $\pm 1 \times 10^{-5}$ at 0 — 50°C	
	within $\pm 3 \times 10^{-5}$ at room temp.	
Power consumption	13W	
Power requirement	AC 120V 50/60Hz (in U.S.A.)	
	AC 220V/240V (Selectable) 50/60Hz (in Europe)	
Semiconductors used...	CPU LSI	1
	FET	1
	IC	29
	Transistors	55
	Diodes	57
Dimensions	180 (182) W	7.09"
	133 (147) H	5.24"
	287 (330) D mm	11.30"
	(Figures in ( ) include projections.)	
Weight	Approx. 3 kg (6.61 Lbs.)	



CIRCUIT CONFIGURATION

The VFO-230 consists of a double PLL loop: the 1st loop covering a 20 kHz bandwidth at 20 Hz step, and the 2nd loop covering a 700 kHz bandwidth at 20 kHz step.

When the tuning dial is turned, an optical encoder (using a photo sensor) converts the dial rotation and its direction of rotation into an electrical signal, which is coupled to microprocessor IC11 (μPD8048C-155).

The microprocessor internally processes this dial signal and outputs the processed result as frequency-division data for the PLL and, at the same time, provides the corresponding dial display data.

In the 1st PLL loop, MIXER-1 (IC14: μPC1037H) combines the output of VCO-1 (Q42, 43) at 14~17.998 MHz with a 10 MHz reference frequency to convert the output to 4.0~7.996 MHz. This output is amplified and coupled to Programmable Divider 1 (IC12), where it is frequency-divided according to the division data from the microprocessor into a 2 kHz signal.

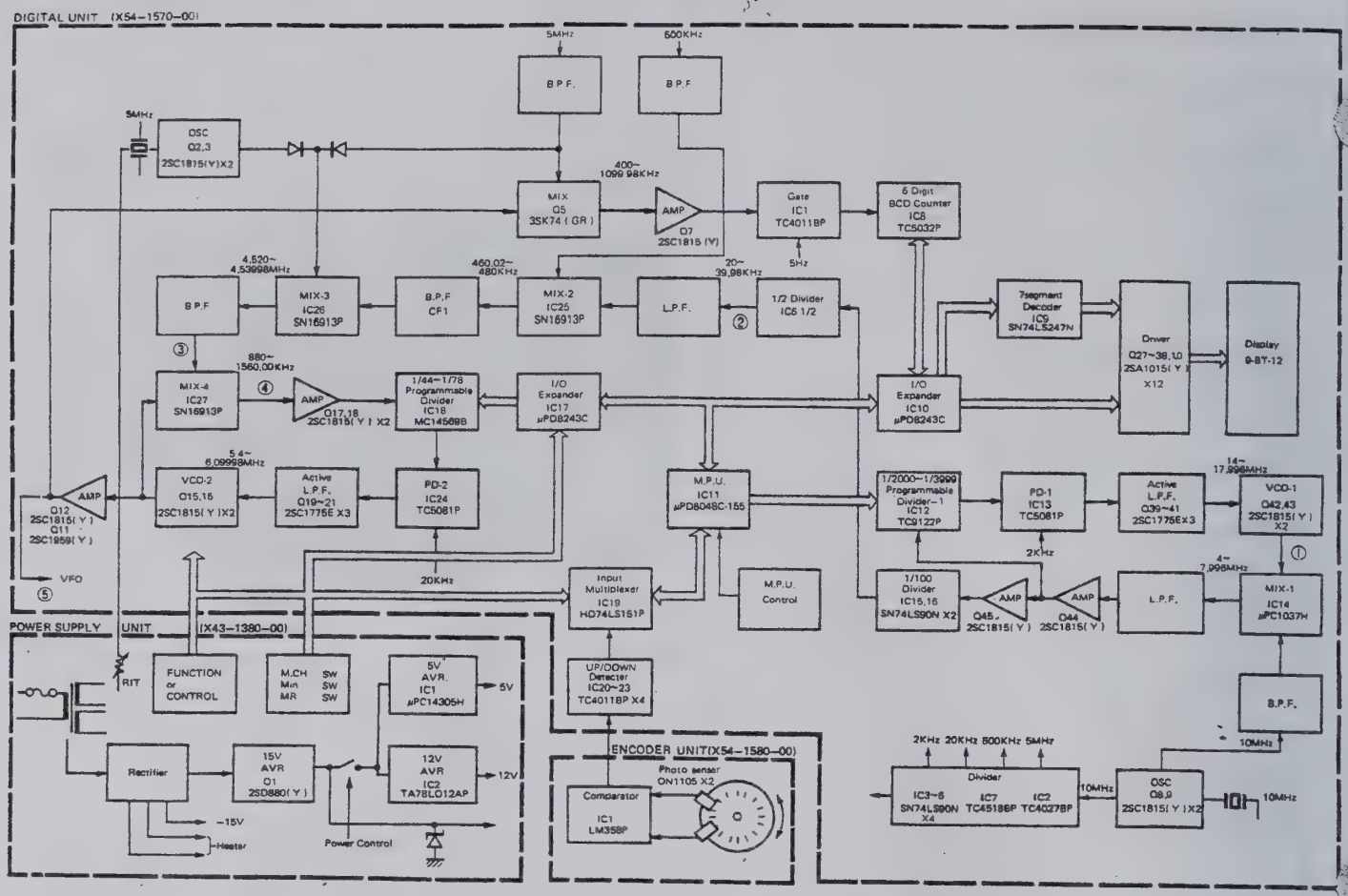
The phase of this 2 kHz signal is compared with that of the reference 2 kHz signal by phase comparator PD-1 (IC13), and this output is fed back to control the output frequency of VCO-1.

The 4~7.998 MHz signal (at 4 kHz steps) generated in the 1st PLL loop is further frequency-divided by a 1/100 (IC15, 16) and 1/2 (IC6 1/2) divider into a 20~39.98 kHz signal (at a 20 Hz step). This signal is coupled to MIXER-2 (IC25), where it is mixed with a reference 500 kHz signal which converts the signal to 480~460.02 kHz. The output of the 2nd mixer goes through a narrow-band ceramic filter (CF1), then couples to a third mixer, MIX-3 (IC27), where it is further mixed with a 5 MHz signal. The signal is now converted to 4520~4539.98 kHz. A reference 5 MHz signal is usually used for the other input of this third mixer. However, it is supplied from the orystal oscillator (Q2) for RIT operation or CW transmission. When the RIT feature is ON, the voltage applied across the varicap diode in the crystal oscillator is varied by the RIT control to obtain a frequency variation range of ±900 Hz. During CW transmission, the voltage across the varicap diode is adjusted by variable resistor VR1 on the digital unit to provide this oscillator with an output frequency 800 Hz higher than its original frequency. The output of MIX-3 goes through a band-pass filter (T2, T3, T4), and then couples to a fourth mixer, MIX-4 (IC-26). Here it is mixed with the output of VCO-2 (5.4~6.09998 MHz) and is converted to 880~1560 kHz. This output, after amplification, is coupled to Programmable Divider 2 where it is frequency-divided to an output frequency of 20 kHz according to the division data supplied from the microprocessor. This output goes to phase detector PD-2 (IC24), where its phase is compared with the 20 kHz reference signal to create the frequency control signal for VCO-2.

All the circuits hitherto described are always operating. However, the digital VFO provides its output intermittently to control the buffer amplifier. When the VFO in the main unit is operating, this VFO output is mixed with a 5 MHz reference signal by MIX-5 (Q5), of which output at 400 kHz to 1099.98 kHz is amplified, then counted up by a 6-digit frequency counter (IC8). The output data of this counter is stored into the microprocessor's memory.

As seen above, all frequencies except the RIT and CW transmission shift frequencies are composed of combinations of reference frequencies. As a result, the accuracy and stability of the digital VFO output frequency is identical to that of the 10 MHz reference oscillator.

VFO-230



VFO-230 BLOCK DIAGRAM

Display f. (kHz)	VFO f. (MHz) ⑤	IC12 14 Bit BCD data (1/M) M	Q42VCO f. (MHz) ①	IC6 (Pin 12) output f. (kHz) ②	IC27 (Pin 5) input f. (kHz) ③	IC18 7 Bit binary (1/N) N	B_3 B_2 B_1 A_4 A_3 A_2 A_1	IC27 output f. (kHz) ④
L 900.0	5.400.00	2 0 0 0	14.000	20.00	4520.00	44	0 1 0 1 1 0 0	880
L 900.0	5.400.02	2 0 0 2	14.004	20.02	4520.02	44	0 1 0 1 1 0 0	880
L 900.1	5.400.10	2 0 1 0	14.020	20.10	4520.10	44	0 1 0 1 1 0 0	880
L 900.8	5.401.60	2 0 8 0	14.160	20.80	4520.80	44	0 1 0 1 1 0 0	880
L 901.0	5.401.00	2 1 0 0	14.200	21.00	4521.00	44	0 1 0 1 1 0 0	880
L 909.9	5.409.98	2 9 9 8	15.896	29.98	4529.98	44	0 1 0 1 1 0 0	880
L 915.0	5.415.00	3 5 0 0	17.000	35.00	4535.00	44	0 1 0 1 1 0 0	880
L 919.9	5.419.98	3 9 9 8	17.996	39.98	4539.98	44	0 1 0 1 1 0 0	880
L 920.0	5.420.00	2 0 0 0	14.000	20.00	4520.00	45	0 1 0 1 1 0 1	900
L 950.0	5.450.00	3 0 0 0	16.000	30.00	4530.00	46	0 1 0 1 1 1 0	920
L 999.9	5.499.98	3 9 9 8	17.996	39.98	4539.98	48	0 1 1 0 0 0 0	960
0.0	5.500.00	2 0 0 0	14.000	20.00	4520.00	49	0 1 1 0 0 0 1	980
10.0	5.510.00	3 0 0 0	16.000	30.00	4530.00	49	0 1 1 0 0 0 1	980
100.0	5.600.00	2 0 0 0	14.000	20.00	4520.00	54	0 1 1 0 1 1 0	1080
200.0	5.700.00	2 0 0 0	14.000	20.00	4520.00	59	0 1 1 1 0 1 1	1180
300.0	5.800.00	2 0 0 0	14.000	20.00	4520.00	64	1 0 0 0 0 0 0	1280
400.0	5.900.00	2 0 0 0	14.000	20.00	4520.00	69	1 0 0 0 1 0 1	1380
500.0	6.000.00	2 0 0 0	14.000	20.00	4520.00	74	1 0 0 1 0 1 0	1480
599.9	6.099.98	3 9 9 8	17.996	39.98	4539.98	78	1 0 0 1 1 1 0	1560

(Note) BAND: ○ ○ .0 MHz (ex. 14.0 MHz)

Table 13. Frequency chart

Ref No.	Parts No.	Description	Re-marks
L13	Not Used		
L14	L33-0636-05	Choke coil	
L15	L40-1511-03	Ferri-inductor 150μH	
L16	L32-0201-05	Oscillating coil	
L17	L40-3391-03	Ferri-inductor 3.3μH	
L18	L40-1511-03	Ferri-inductor 150μH	☆
L19, 20	L34-0540-05	Tuning coil 455kHz	
L21,22	L40-1021-03	Ferri-inductor 1mH	
L23	Not Used		
L24	L34-0539-15	Tuning coil 455kHz BM	
L25	L34-0664-05	Tuning coil 455kHz	
L26,27	L34-0540-05	Tuning coil 455kHz	
L28	L34-0536-05	Tuning coil 8.83MHz	
L29	L34-0946-05	Tunig coil 8.83MHz	☆
L31	L40-1511-03	Ferri-inductor 150μH	
L32	L40-1021-03	Ferri-inductor 1mH	
CF1	L72-0310-05	Ceramic filter 8.83MHz NB	
CF2	L72-0314-15	Ceramic filter 455kHz SSB	
XF1	L71-0222-05	Monolithic filter 8.83MHz SSB	
X1	L77-0801-05	Crystal 8.375MHz	
VR1,2	R12-3045-05	Trim. pot 10kΩ	
VR3	R12-6401-05	Trim. pot 470kΩ	
VR4	R12-0401-05	Trim. pot 100Ω	
VR5	R12-1039-05	Trim. pot 2.2kΩ	
VR6	R12-3045-05	Trim pot 10kΩ	
VR7	R12-6401-05	Trim. pot 470kΩ	
VR8	R12-3046-05	Trim. pot 47kΩ	
	R92-0150-05	Short jumper	
R203	RS14GB3D471J	Metal film 470Ω 2W	

AF unit (X49-1140-00)

Ref. No.	Parts No.	Description	Re-marks
C2～5	CQ92M1H123K	ML 0.012μF 50V	
C6	CE04W1E100Q	E 10μF 25V	
C8	CE04W1H010	E 1μF 50V	
C9	CE04W1A101Q	E 100μF 10V	
C10	CQ92M1H273K	ML 0.027μF 50V	
C11	CE04W1HR47	E 0.47μF 50V	
C13	CE04W1A470Q	E 47μF 10V	
C14,15	CQ92M1H273K	ML 0.027μF 50V	
C16	CQ92M1H473K	ML 0.047μF 50V	
C17	CQ92M1H273K	ML 0.027μF 50V	
C18	CQ92M1H473K	ML 0.047μF 50V	
C19	CE04W1E100Q	E 10μF 25V	
C20	CE04W1HR47	E 0.47μF 50V	
C21,22	CE04W1E100Q	E 10μF 25V	
C23	CE04AW1H0R1M	E 0.1μF 50V	
C24	CE04W1H010	E 1μF 50V	
C25	CQ92M1H472K	ML 0.0047μF 50V	
C27	CE04W1E100Q	E 10μF 25V	
C28	CE04W1C471M	E 470μF 16V	
C29,30	CC45SL1H120J	C 12pF	
C31, 32	CE04W1C470Q	E 47μF 16V	
C33	CQ92M1H104K	ML 0.1μF 50V	
C34	CE04W1C221Q	E 220μF 16V	
C35	CQ92M1H103K	ML 0.01μF 50V	
C36	CE04AW1H0R1M	E 0.1μF 50V	

Ref. No.	Parts No.	Description	Re-mark
C37, 38	CE04W1A470Q	E 47μF 10V	
C39	CE04W1C470Q	E 47μF 16V	
C41	CE04W1H3R3	E 3.3μF 50V	
C42	CE04W1E100Q	E 100μF 25V	
C43	CE04W1H010	E 1μF 50V	
C44	CQ92M1H103K	ML 0.01μF	
C45	CE04W1E100Q	E 10μF 25V	
C46	CQ92M1H472K	ML 0.0047μF 50V	
C47	CQ92M1H473K	ML 0.047μF 50V	
C48,49	CE04W1H3R3	E 3.3μF 50V	
C51,52	CK45E2H103P	C 0.01μF 500V	
C53,54	CQ93M2A473K	ML 0.047μF 100V	
C58	CQ93M2A224M	ML 0.22μF 100V	
C60	CE04W1HR47	E 0.47μF 50V	
C67	CC45SL1H100D	C 10pF ±0.5pF	
C70	CE04W1H010	E 1μF 50V	
C74	CE04W1H010	E 1μF 50V	
C78	CE04W1C470Q	E 47μF 16V	
C81	CE04W1C102M	E 1000μF 16V	
C82	CE04W1H3R3	E 3.3μF 50V	
C83, 84	C90-0807-05	E 2200μF 25V	
C89	CE04W1A470Q	E 47μF 10V	
C90	C91-0456-05	C 0.047μF	
C91	CE04W1E100Q	E 10μF 25V	
	E23-0047-04	Square terminal	
	F20-0516-05	Insulating sheet	☆
	F29-0014-05	Shoulder washer	☆
	J31-0502-04	PC board collar	
	J42-0404-05	PC board bush	
T1	L34-0535-05	Tuning coil NB Red	
T2	L34-0536-05	Tuning coil NB Blue	
L1	L40-3392-02	Ferri-inductor 3.3μH	
L2～4	L40-1511-03	Ferri-inductor 150μH	
L5	L15-0016-05	Choke trans	
VR1	R12-3411-05	Trim. Pot 47kΩ	
VR2	R12-3413-05	Trim. Pot 10kΩ	☆
VR3	R12-3411-05	Trim. Pot 47kΩ	
VR4	R12-0413-05	Trim. Pot 470Ω	
	R92-0150-05	Short jumper	
RL1	S51-4401-05	Relay DC12V	

PLL unit (X50-1680-00)

Ref. No.	Parts No.	Description	Re-marks
C1	CE04W1A470Q	E 47μF 10V	
C2	CC45TH1H270J	C 27pF	
C3	CC45TH1H180J	C 18pF	
C4	CC45TH1H270J	C 27pF	
C5	CE04W1A470Q	E 47μF 10V	
C6	CC45UJ1H101J	C 100pF	
C7	CC45UJ1H150J	C 15pF	
C10	CE04W1A470Q	E 47μF 10V	
C11	CC45TH1H330J	C 33pF	
C12	CC45TH1H220J	C 22pF	
C13	CC45TH1H270J	C 27pF	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
C14	CE04W1A470Q	E 47μF 10V	
C15	CC45SH1H680J	C 68pF	
C16	CC45RH1H221J	C 220pF	
C18	CC45TH1H180J	C 18pF	
C19	CC45TH1H150J	C 15pF	
C21	CE04W1A470Q	E 47μF 10V	
C22	CC45UJ1H270J	C 27pF	
C23	CC45TH1H101J	C 100pF	
C24.25	CC45UJ1H120J	C 12pF	
C27	CE04W1A470Q	E 47μF 10V	
C28	CC45UJ1H820J	C 82pF	
C29	CC45UJ1H150J	C 15pF	
C30	CE04W1A470Q	E 47μF 10V	
C31	CC45TH1H270J	C 27pF	
C32	CC45UJ1H050C	C 5pF ±0.25pF	
C33	CC45UJ1H220J	C 22pF	
C34	CE04W1A470Q	E 47μF 10V	
C35	CC45UJ1H070D	C 7pF ±0.5pF	
C36	CC45UJ1H220J	C 22pF	
C38	CE04W1A470Q	E 47μF 10V	
C40	CC45UJ1H180J	C 18pF	
C41	CC45UJ1H090D	C 9pF ±0.5pF	
C42	CC45TH1H150J	C 15pF	
C43	CE04W1A470Q	E 47μF 10V	
C44	CC45UJ1H100D	C 10pF ±0.5pF	
C45	CC45UJ1H270J	C 27pF	
C47	CC45TH1H150J	C 15pF	
C48	CC45TH1H050C	C 5pF ±0.25pF	
C51	C91-0456-05	C 0.047μF	
C53	C91-0456-05	C 0.047μF	
C54.55	CC45SL1H121J	C 120pF	
C56	CC45SL1H151J	C 150pF	
C57	CC45CH1H010C	C 1pF ±0.25pF	
C58	CC45SL1H050C	C 5pF ±0.25pF	
C67	CC45SL1H330J	C 33pF	
C68.69	CC45SL1H680J	C 68pF	
C70	CC45SL1H330J	C 33pF	
C71.72	CC45SL1H221J	C 220pF	
C74	C91-0456-05	C 0.047μF	
C76	C91-0456-05	C 0.047μF	
C80	CE04W1H010Q	E 1μF 50V	
C82	C91-0456-05	C 0.047μF	
C87	CQ92M1H102K	ML 0.001μF 50V	
C88	CQ92M1H104K	ML 0.1μF 50V	
C89	C91-0456-05	C 0.047μF	
C90.91	CE04W1A101Q	E 100μF 10V	
C92	CE04W1A470Q	E 47μF 10V	
C94	CE04W1A101M	E 100μF 10V	
C95	CC45SL1H390J	C 39pF	
C97	CC45SL1H331J	C 330pF	
C98	CC45SL1H470J	C 47pF	
C99	CC45SL1H150J	C 15pF	
C100	CC45SL1H470J	C 47pF	
C101	CC45SL1H270J	C 27pF	
C102	CC45SL1H560J	C 56pF	
C103	CC45SL1H270J	C 27pF	
C104	CC45SL1H470J	C 47pF	
C105	C91-0456-05	C 0.047μF	
C106	CC45SL1H470J	C 47pF	
C107	CC45SL1H070D	C 7pF ±0.5pF	
C109	C91-0456-05	C 0.047μF	
C111	CC45SL1H101J	C 100pF	

Ref. No.	Parts No.	Description	Remarks
C112	CC45SL1H221J	C 220pF	
C113	CC45SL1H101J	C 100pF	
C115	CC45RH1H100D	C 10pF ±0.5pF	
C116	CC45TH1H050C	C 5pF ±0.25pF	
C117	CC45CH1H010C	C 1pF ±0.25pF	
C118	CC45RH1H560J	C 56pF	
C120	CC45CH1H020C	C 2pF ±0.25pF	
C121	CC45SL1H470J	C 47pF	
C123	CC45RH1H390J	C 39pF	
C125	CC45TH1H330J	C 33pF	
C126	CC45TH1H150J	C 15pF	
C127	CC45TH1H330J	C 33pF	
C130	CC45UJ1H150J	C 15pF	
C131	CC45UJ1H050C	C 5pF ±0.25pF	
C132	CC45UJ1H150J	C 15pF	
C139	CC45SL1H100D	C 10pF ±0.5pF	
C140	CC45RH1H220J	C 22pF	
C142	CC45RH1H470J	C 47pF	
C143	CC45RH1H220J	C 22pF	
C144	CC45RH1H470J	C 47pF	
C145	CC45SL1H220J	C 22pF	
C146	CC45SL1H151J	C 150pF	
C148	CC45SL1H050C	C 5pF ±0.25pF	
C149	CC45SL1H220J	C 22pF	
C159	CC45SL1H330J	C 33pF	
C160	CC45SL1H100D	C 10pF ±0.5pF	
C162	CC45CH1H010C	C 1pF ±0.25pF	
C163	CC45SL1H150J	C 15pF	
C166	CC45SL1H100D	C 10pF ±0.25pF	
C167	CC45CH1H020C	C 2pF ±0.25pF	
C169	CC45SL1H101J	C 100pF	
C172	C91-0456-05	C 0.047μF	
C173	CC45CH1H010C	C 1pF ±0.25pF	
C174	CC45UJ1H680J	C 68pF	
C178.179	CC45SL1H220J	C 22pF	
C182.183	C91-0456-05	C 0.047μF	
C184	CC45CH1H270J	C 27pF	
C185	CC45CH1H390J	C 39pF	
C186	CC45CH1H101J	C 100pF	
C187	CC45SL1H221J	C 220pF	
C188	CC45SL1H220J	C 22pF	
C189	CC45SL1H050C	C 5pF ±0.25pF	
C194	CE04W1A470Q	E 47μF 10V	
C196	CC45SL1H100D	C 10pF ±0.5pF	
C197~202	C91-0456-05	C 0.047μF	
C205	CE04W1HR47M	E 0.47μF 50V	
TC1	C05-0029-15	Ceramic trimmer 50pF	
TC2.3	C05-0056-05	Ceramic trimmer 30pF	
TC4	C05-0030-15	Ceramic trimmer 20pF	
	E04-0154-05	Coax connector	
	E18-0201-05	Crystal socket	
	E23-0046-04	Square terminal	
T1	L32-0195-05	Oscillating coil 7.10MHz	
T2	L32-0193-05	Oscillating coil 1.5, 3.5 MHz	
T3	L32-0196-05	Oscillating coil 14 MHz	
T4	L32-0199-05	Oscillating coil 18MHz	
T5	L32-0198-05	Oscillating coil 28MHz	
T6	L32-0197-05	Oscillating coil 21, 24.5MHz	
T7	L34-0714-05	Tuning coil	
T8	L34-0715-05	Tuning coil	

Ref No.	Parts No.	Description	Re-marks
L13	Not Used		
L14	L33-0636-05	Choke coil	
L15	L40-1511-03	Ferri-inductor 150μH	
L16	L32-0201-05	Oscillating coil	
L17	L40-3391-03	Ferri-inductor 3.3μH	
L18	L40-1511-03	Ferri-inductor 150μH	☆
L19,20	L34-0540-05	Tuning coil 455kHz	
L21,22	L40-1021-03	Ferri-inductor 1mH	
L23	Not Used		
L24	L34-0539-15	Tuning coil 455kHz BM	
L25	L34-0664-05	Tuning coil 455kHz	
L26,27	L34-0540-05	Tuning coil 455kHz	
L28	L34-0536-05	Tuning coil 8.83MHz	
L29	L34-0946-05	Tunig coil 8.83MHz	☆
L31	L40-1511-03	Ferri-inductor 150μH	
L32	L40-1021-03	Ferri-inductor 1mH	
CF1	L72-0310-05	Ceramic filter 8.83MHz NB	
CF2	L72-0314-15	Ceramic filter 455kHz SSB	
XF1	L71-0222-05	Monolithic filter 8.83MHz SSB	
X1	L77-0801-05	Crystal 8.375MHz	
VR1,2	R12-3045-05	Trim. pot 10kΩ	
VR3	R12-6401-05	Trim. pot 470kΩ	
VR4	R12-0401-05	Trim. pot 100Ω	
VR5	R12-1039-05	Trim. pot 2.2kΩ	
VR6	R12-3045-05	Trim pot 10kΩ	
VR7	R12-6401-05	Trim. pot 470kΩ	
VR8	R12-3046-05	Trim. pot 47kΩ	
	R92-0150-05	Short jumper	
R203	RS14GB3D471J	Metal film 470Ω 2W	

AF unit (X49-1140-00)

Ref. No.	Parts No.	Description	Re-marks
C2～5	CQ92M1H123K	ML 0.012μF 50V	
C6	CE04W1E100Q	E 10μF 25V	
C8	CE04W1H010	E 1μF 50V	
C9	CE04W1A101Q	E 100μF 10V	
C10	CQ92M1H273K	ML 0.027μF 50V	
C11	CE04W1HR47	E 0.47μF 50V	
C13	CE04W1A470Q	E 47μF 10V	
C14,15	CQ92M1H273K	ML 0.027μF 50V	
C16	CQ92M1H473K	ML 0.047μF 50V	
C17	CQ92M1H273K	ML 0.027μF 50V	
C18	CQ92M1H473K	ML 0.047μF 50V	
C19	CE04W1E100Q	E 10μF 25V	
C20	CE04W1HR47	E 0.47μF 50V	
C21,22	CE04W1E100Q	E 10μF 25V	
C23	CE04AW1H0R1M	E 0.1μF 50V	
C24	CE04W1H010	E 1μF 50V	
C25	CQ92M1H472K	ML 0.0047μF 50V	
C27	CE04W1E100Q	E 10μF 25V	
C28	CE04W1C471M	E 470μF 16V	
C29,30	CC45SL1H120J	C 12pF	
C31,32	CE04W1C470Q	E 47μF 16V	
C33	CQ92M1H104K	ML 0.1μF 50V	
C34	CE04W1C221Q	E 220μF 16V	
C35	CQ92M1H103K	ML 0.01μF 50V	
C36	CE04AW1H0R1M	E 0.1μF 50V	

Ref. No.	Parts No.	Description	Re-marks
C37,38	CE04W1A470Q	E 47μF 10V	
C39	CE04W1C470Q	E 47μF 16V	
C41	CE04W1H3R3	E 3.3μF 50V	
C42	CE04W1E100Q	E 100μF 25V	
C43	CE04W1H010	E 1μF 50V	
C44	CQ92M1H103K	ML 0.01μF	
C45	CE04W1E100Q	E 10μF 25V	
C46	CQ92M1H472K	ML 0.0047μF 50V	
C47	CQ92M1H473K	ML 0.047μF 50V	
C48,49	CE04W1H3R3	E 3.3μF 50V	
C51,52	CK45E2H103P	C 0.01μF 500V	
C53,54	CQ93M2A473K	ML 0.047μF 100V	
C58	CQ93M2A224M	ML 0.22μF 100V	
C60	CE04W1HR47	E 0.47μF 50V	
C67	CC45SL1H100D	C 10pF ±0.5pF	
C70	CE04W1H010	E 1μF 50V	
C74	CE04W1H010	E 1μF 50V	
C78	CE04W1C470Q	E 47μF 16V	
C81	CE04W1C102M	E 1000μF 16V	
C82	CE04W1H3R3	E 3.3μF 50V	
C83,84	C90-0807-05	E 2200μF 25V	
C89	CE04W1A470Q	E 47μF 10V	
C90	C91-0456-05	C 0.047μF	
C91	CE04W1E100Q	E 10μF 25V	
	E23-0047-04	Square terminal	
	F20-0516-05	Insulating sheet	☆
	F29-0014-05	Shoulder washer	☆
	J31-0502-04	PC board collar	
	J42-0404-05	PC board bush	
T1	L34-0535-05	Tuning coil NB Red	
T2	L34-0536-05	Tuning coil NB Blue	
L1	L40-3392-02	Ferri-inductor 3.3μH	
L2～4	L40-1511-03	Ferri-inductor 150μH	
L5	L15-0016-05	Choke trans	
VR1	R12-3411-05	Trim. Pot 47kΩ	
VR2	R12-3413-05	Trim. Pot 10kΩ	☆
VR3	R12-3411-05	Trim. Pot 47kΩ	
VR4	R12-0413-05	Trim. Pot 470Ω	
	R92-0150-05	Short jumper	
RL1	S51-4401-05	Relay DC12V	

PLL unit (X50-1680-00)

Ref. No.	Parts No.	Description	Re-marks
C1	CE04W1A470Q	E 47μF 10V	
C2	CC45TH1H270J	C 27pF	
C3	CC45TH1H180J	C 18pF	
C4	CC45TH1H270J	C 27pF	
C5	CE04W1A470Q	E 47μF 10V	
C6	CC45UJ1H101J	C 100pF	
C7	CC45UJ1H150J	C 15pF	
C10	CE04W1A470Q	E 47μF 10V	
C11	CC45TH1H330J	C 33pF	
C12	CC45TH1H220J	C 22pF	
C13	CC45TH1H270J	C 27pF	